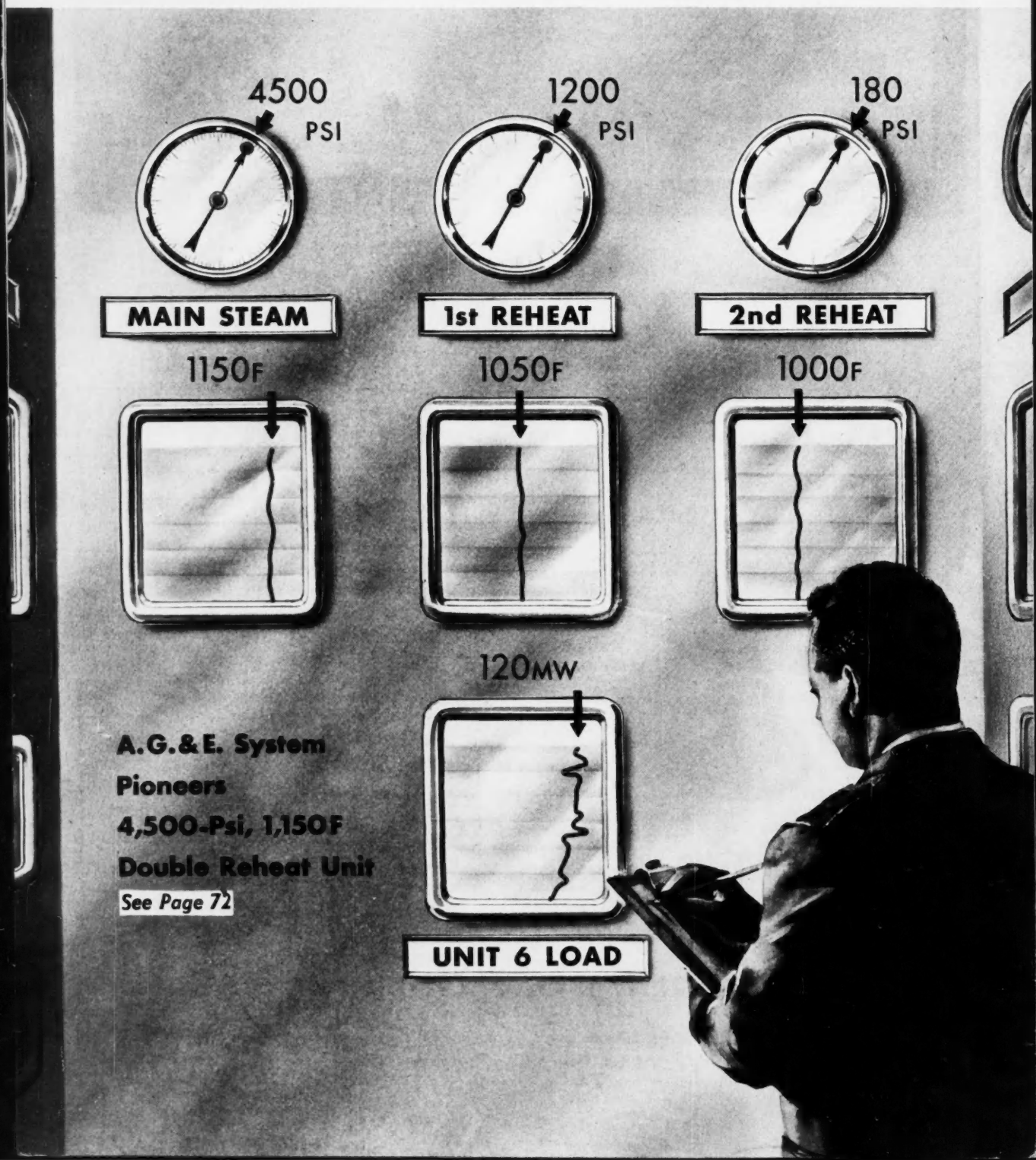
JUNE 29, 1953

Electrical World

Price 35 Cents

A McGRAW-HILL PUBLICATION



A.G.&E. System Pioneers 4,500-Psi, 1,150F Double Reheat Unit

See Page 72

IN 3 EASY STEPS

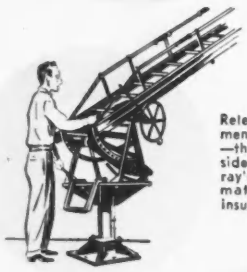
with the Murray Crows'nest

REGISTERED TRADE MARK

1

JUST A SLIGHT PRESSURE

Pull out the handle, press down. That's all that's needed to release ladder from riding position and raise it to the desired inclination. Husky spring action does most of the work. Release handle to lock the ladder.



2

ROTATE

Release locking arrangement. Rotate full 360° easily —there is a handle on each side for convenience. Murray's exclusive semi-automatic mechanism thruout insures complete safety.

3

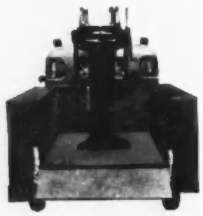
EXTEND

Because of large drum, only a few turns on the windlass are necessary to extend upper section of ladder. The 24" long flat floor of the platform is adjustable to suit any of the inclinations— 30° to 72°

LEAVES PLENTY OF FLOOR SPACE

Even on low priced pick-up trucks, the Murray Crows'nest leaves the absolute maximum in standing and loading space. Rotation at 37½" is above usual height of cabinets.

In the riding position, the Murray Crows'nest snuggles close to the top of the cab. Low center of gravity keeps the truck in good balance.



Your men can do more jobs per day because operation of the Murray Crows'nest is quicker, easier and less fatiguing. Each of the steps — inclination, rotation and extension — is easy-flowing and effortless. The reason is simple — Murray engineers have designed the Crows'nest to do most of the work itself. Every part is in perfect balance so that only a slight pressure is needed to start each action.

MURRAY MANUFACTURING CORPORATION
1250 Atlantic Avenue, Brooklyn 16, N. Y.

Send specifications, drawings, mounting instructions and quote on:

29'..... 32'9..... 36'8.....
Pedestal Style Crows'nest

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

.....

Murray®

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1250 Atlantic Avenue, Brooklyn 16, New York

Service Entrance and Meter Equipment • Magnetic Hydraulic Circuit Breakers
Safety Switches (Types A, C & D). • Current Limiting Reactors • Utility Specialties

These Deserve the Credit

In this issue EW continues the report of the feasibility studies made by the four utility-industrial teams begun in the June 1 issue. But names are absent from these excellent stories. This obviously is unfair to the many engineers and scientists who prepared the original report on which EW's articles are based. So we asked their companies to name them. Here they are:

Commonwealth Edison Co-Public Service Co of Northern Illinois . . . Murray Joslin, project manager; R. B. Gear, technical director; L. A. Evers, secretary; Dr Lyle B. Borst, consultant; E. C. Bailey; D. R. Bower; W. M. Kiefer; M. S. Oldacre; E. G. Jones; T. L. Redman; E. L. Tornquist; and F. W. McCloska, Sargent & Lundy, consulting engineers on the project.

Pacific Gas & Electric Co-Bechtel Corp . . . J. B. Black, N. R. Sutherland, I. C. Steele, W. Dreyer, C. C. Whelchel, W. R. Johnson, W. H. Nutting, and J. B. Cooke, all of PG&E. J. P. Yates, J. C. Byrne, J. R. Kiely, J. N. Landis, G. L. Way, H. F. Brush, and R. A. Bowman, all of Bechtel.

Union Electric Co of Missouri-Monsanto Chemical Co . . . Kenneth A. Hub, chief of engineering, Monsanto; C. Rogers McCullough, technical director of atomic energy project, Monsanto; Estell M. Mabuce, project engineer, Union Electric; Leo A. Ohlinger, consultant, director of computing, Northrup Aircraft; and Milton Welhoelter, chief engineer of atomic energy project, Monsanto.

Detroit Edison Co-Dow Chemical Co . . . Dr John J. Grebe and Alden W. Hanson, Dow Chemical; John Menke, Nuclear Development Associates, Inc; W. T. Moore, Babcock & Wilcox Co; Walker L. Cisler, Altin P. Donnell, and Harvey A. Wagner, Detroit Edison.

These are the men their companies believe deserve the credit for directing these great projects. Still unnamed are the hundreds of others who contributed in some way. EW salutes the named and the unnamed for their great contributions.

Electrical World

Published for 78 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Published weekly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. **Publication Office, 99-129 North Broadway, Albany 1, N. Y. Executive, Editorial and Advertising Office: McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y.** Curtis W. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Subscriptions: Address correspondence to Electrical World—Subscription Service, 99-129 N. Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

Subscriptions are accepted from executive, supervisory and engineering personnel in electric utilities, manufacturing companies, and related fields. Positions and company connection must be indicated on subscription orders.

Single copies 35¢. For the United States and Possessions $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money, at par.) Other Western Hemisphere, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in USA.

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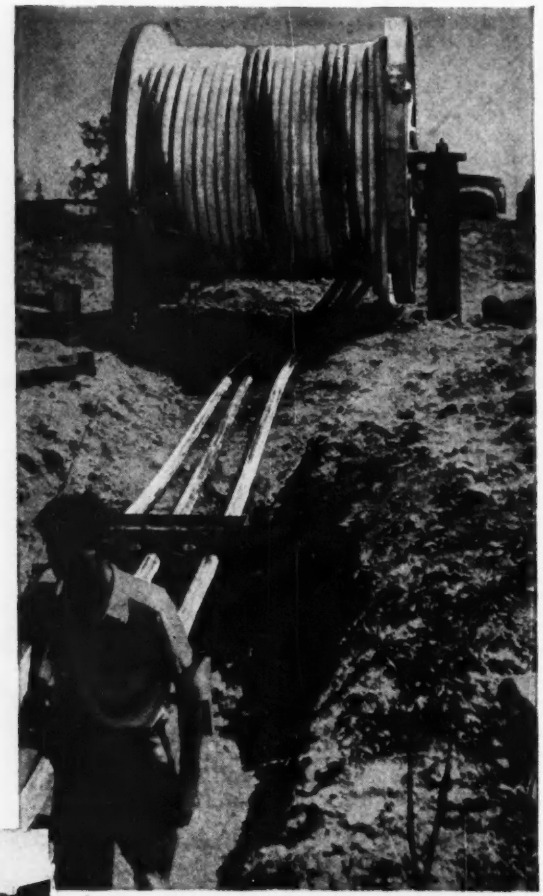
ingenious methods simplified laying of three Okonite submarine cables

Three 12,000-volt Okonite submarine cables, each 830 feet long were installed as outgoing power lines across the Colorado River for a new addition to the Municipal Power Plant of the City of Austin, Texas. Some of the details of this unusual installation are given below:



To simplify the laying, the three lengths of cable were paralleled on one steel reel 10 feet in diameter. Because of the shallow water and the great weight of the reel and cable (over 46,000 lbs.) the usual method of mounting the reel on a barge was impractical. Instead, the reel was cradled on a concrete foundation and the cables were passed through a feeder mechanism to provide proper spacing.

The three cables were attached to a special steel bridle weighing over 400 pounds, so they could be pulled at the same time. Two 50-gallon oil drums were used to float the bridle.

Oil drums spaced 10 feet apart were also used to float the cables. When the cables had been pulled across the river they were lowered into a trench dug by dragline five feet below the bed of the river. The submarine cables were then spliced to Okolite-Okoprene cables in manholes at each end of the submarine line run.

Tough and unusual cable installations have a way of turning out to be Okonite. We'd be glad to send you the full facts on *this* job—or to assist in helping you to solve a particular cable problem of your own. Just write The Okonite Company, Passaic, N. J.

CONSULTING ENGINEERS: Burns & McDonnell Engineering Co., Kansas City, Missouri. ELECTRICAL CONTRACTOR: W. K. Jennings Electric Co., Austin, Texas. JOBBER: Priester Supply Co., Dallas, Texas.

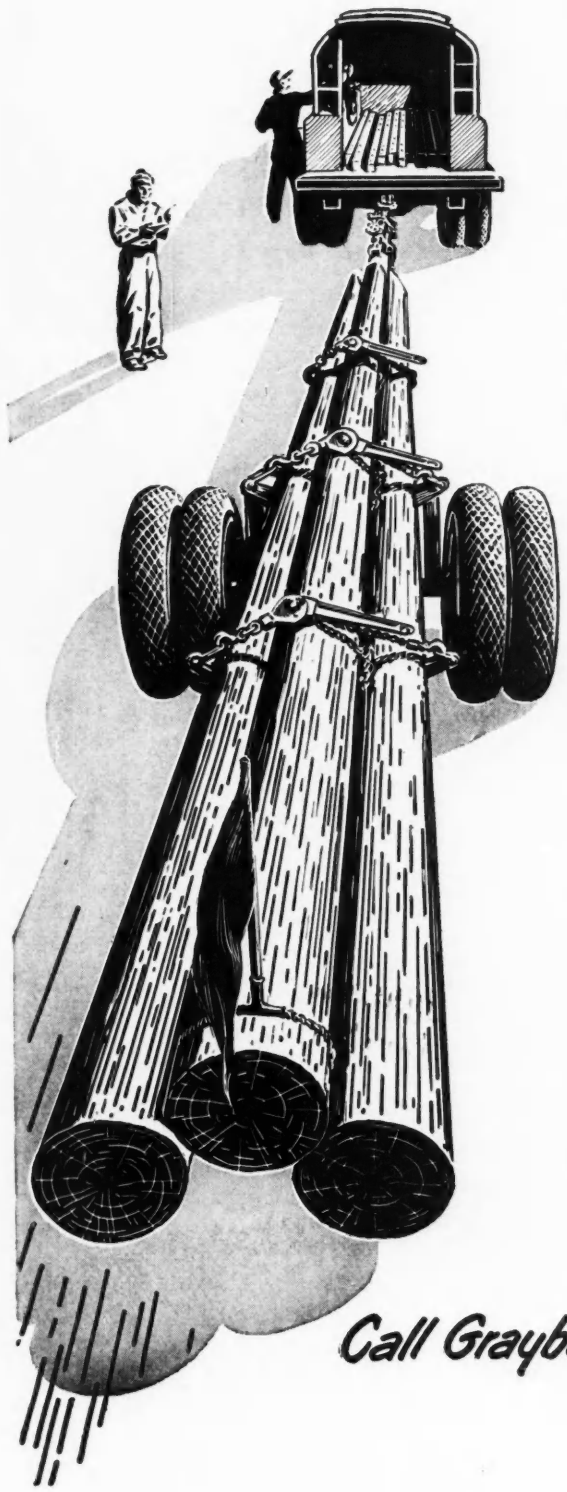
OKONITE *insulated cables*

OKONITE 75

1430

POLES and CROSSARMS

– via GraybaR



There's a type of pole and crossarm for every power-line requirement. And an order placed with Graybar means that you can get the kind you need *when* and *where* you need it.

Because differing conditions influence local preferences, Graybar distributes *all* types of poles – full-length, pressure-treated Fir and Cedar... butt-treated Northern and Western Cedar. They're all carefully selected and processed to provide maximum strength and durability.

Graybar-distributed crossarms are seasoned under rigid methods – are strong, long-lasting and provide a wide margin of safety in the line.

For help in solving usual, and *unusual*, pole-line problems, call on Graybar Outside Construction Specialists – they're located in key areas throughout the nation. And for convenience, speed and direct action, route all your line material orders via Graybar. *Graybar Electric Co., Inc. Executive Offices: Graybar Building, 420 Lexington Avenue, New York 17, N. Y.*

309-96

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National pressure-treated Douglas Fir poles
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National butt-treated Cedar poles
Rainier Fir crossarms

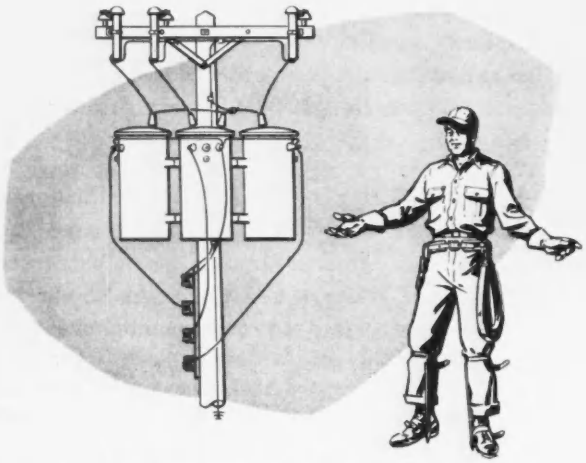
Call Graybar first for...

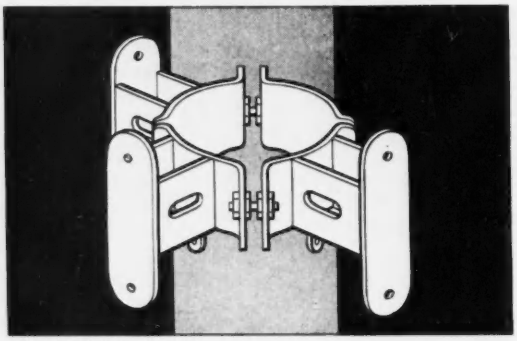
GraybaR *Everything Electrical*

IN OVER 100 PRINCIPAL CITIES

HANGING TRANSFORMERS WITH CLAMP TYPE
UNIVERSAL BRACKETS

SAVES UP TO 60% OF INSTALLATION COSTS





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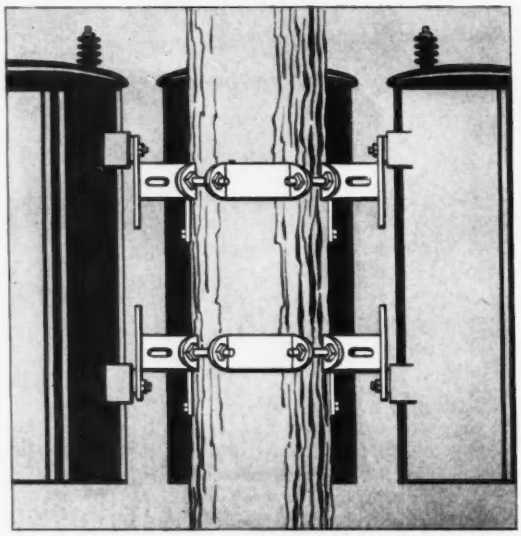
With Universal Brackets you simplify the hanging of transformers and capacitors.

Actual labor time is greatly reduced by eliminating: Gaining the pole — drilling holes — excessive material handling.



NO OTHER HANGING METHOD HAS ALL THESE ADVANTAGES

- **VERSATILE** – Will mount all combinations of transformer sizes. Standard sized units will fit any pole from 6 inches to 10½ inches in diameter.
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- **LOW COST** – 30 per cent to 60 per cent less cost per installation.

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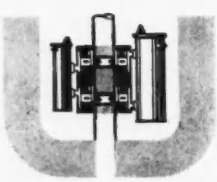
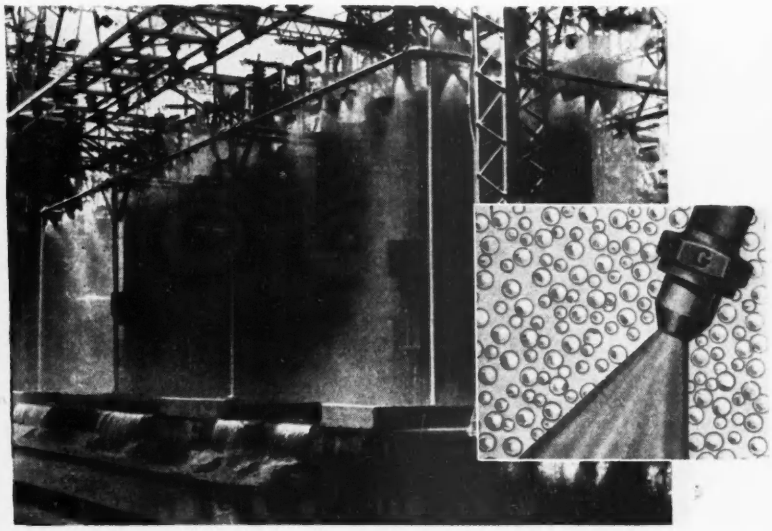


Partial list of Public Utility Companies relying on Grinnell Mulsifyre System

Alabama Power Co.
Appalachian Electric Co.
Boston Edison Company
Braddock Light & Power Co.
Buckeye Valley Gas & Electric Co.
Central New York Power Co.
Cincinnati Gas & Electric Co.
City of Seattle, Dept. of Lighting
Cleveland Electric Illuminating Co.
Commonwealth Edison Company
Cliffs Power & Light Company
Connecticut Power Company
Consolidated Edison (N.Y.)
Consolidated Gas Electric Light & Power Company of Baltimore
Consumers Power Company
Dallas Power & Light Company
Dayton Power & Light Company
Delaware Power & Light Company
Detroit Edison Company
Duke Power Company
Duquesne Light Company
Eastern Shore Public Service Co.
Florida Power & Light Company
Gulf States Utilities
Houston Light and Power Co.
Indianapolis Power & Light Co.
Kansas Gas & Electric Company
Lexington Power & Light Company
Long Island Lighting Co.
Louisville Gas & Electric Co.
Louisiana Light & Power Co.
Luzerne County Gas & Electric Co.
Madison Light & Power Company
Mississippi Electric Company
Narragansett Electric Co.
Nebraska Power Company
New Orleans Public Service
Niagara Mohawk Power Co.
Ohio Edison Company
Ohio Power Company
Oklahoma Gas & Electric Co.
Omaha Public Power District
Pennsylvania Electric Co.
Pennsylvania Power Co.
Pennsylvania Power and Light Co.
Pennsylvania Water & Power Co.
Philadelphia Electric Company
Potomac Electric Company
Public Service Co. of Colorado
Public Service of New Jersey
South Carolina Electric & Gas Co.
Southern Indiana Gas & Electric Co.
Staten Island Edison Company
Texas Power & Light Company
Toledo Edison Company
Union Electric Company of Illinois
Union Electric Company of Missouri
Virginia Electric & Power Co.
West Penn Power Co.
Williamsburgh Power Plant
Wisconsin Public Service Co.



OIL FIRES

From our files . . . facts about 3 typical oil fires which Grinnell Mulsifyre System quickly, safely

EXTINGUISHED

Complete extinguishment of fires within areas protected with Grinnell Mulsifyre sprays is usually obtained in a matter of a few seconds after the water discharge starts. Case histories prove that Mulsifyre projectors are effective wherever the danger of fire in medium or heavy oils can be limited to a definite area. In these oils the surface emulsion remains to give after-protection against flashback.

Avoid future trouble from fire. Check the facts below on the reliable way Grinnell emulsion-forming spray systems operate. Then communicate with Grinnell Company Inc., Providence, R. I. or with one of the branch offices located in principal cities.

The record speaks for itself . . .

1. This is a case of a bank of three 12,500 KVA single phase transformers, oil insulated and water cooled. An arc flashed below the oil surface from low voltage leads to the iron core. Relief diaphragm ruptured, forcing out oil whose vapors ignited. Automatically operated Mulsifyre System extinguished the fire before it could damage adjacent transformers.

2. Here's another instance . . . drizzle-wetted coal dust, streaking on an insulator, caused a flash-over which ignited an oil spill. Manual operation of a gate valve turned on the fixed Mulsifyre System, extinguishing the fire.

3. And another! Repeated operations of automatic circuit breakers due to severe electric storm caused oil spray and spillage which was ignited by flames coming from tanks through explosion vents. The explosion blew out three outside brick walls of switch room. The Mulsifyre fire protection system went into action and it extinguished the resultant fire.

GRINNELL *Mulsifyre*

EMULSION-EXTINGUISHMENT OF OIL FIRES

IDAHO POWER COMPANY'S UNUSUAL
C. J. STRIKE DEVELOPMENT
. . . AN OUTSTANDING EXAMPLE OF

Engineering VISION!

PP INC.

It takes a lot of engineering vision as well as business acumen to put through the type of power expansion program being pushed by Idaho Power Company. Six new power plants since 1945 and an increase in capacity of 250% represents an outstanding example of sound growth.

Latest plant on the line is the C. J. Strike hydro plant on the Snake River where Idaho Power whipped some of the toughest design problems in its 36 years of hydro-electric development. Porcelain Products Switch & Bus Insulators were chosen for the C. J. Strike plant to satisfy critical engineering demands for insulators with built-in stamina, ruggedness and dependability. You too can depend on Porcelain Products' background of ceramic engineering knowledge to satisfy your most critical insulator needs.

Export Representative: Philips Export Corp., 100 E. 42nd Street, New York 17, N.Y.

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Porcelain Products, Inc.

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LATE CITY EDITION

THE EV

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EXTRA!

Insulation Stamina

with

ANHYDREX XX

Where your operations demand exceptional resistance to moisture, ozone, heat, and aging, ANHYDREX XX has the extra insulation stamina that means longer-life and trouble-free service. ANHYDREX XX specially compounded insulation will give you uninterrupted service year in and year out at 2,000-17,000 volts in underground, duct, or aerial installations.

Our research engineers aged ANHYDREX XX for sixteen weeks under the grueling temperature of 250°F. (121°C). ANHYDREX XX retained its excellent electrical properties as well as its rubber-like characteristics. We subjected a vegetable oil compound to the same test and after only one week it lost its rubber-like characteristics. A heat-resistant compound had the same result after three weeks of testing. Both compounds became brittle and when bent cracked and crumbled. There is no better proof anywhere that ANHYDREX XX is tops in high voltage insulation.

The next time you need high voltage cables be sure to specify ANHYDREX XX for economy, quality, and satisfaction. ANHYDREX XX Insulated Cables offer the kind of performance that reduces maintenance and replacement costs. For more complete information about what ANHYDREX XX will do for you, contact your nearest Simplex representative or write in care of the address below.

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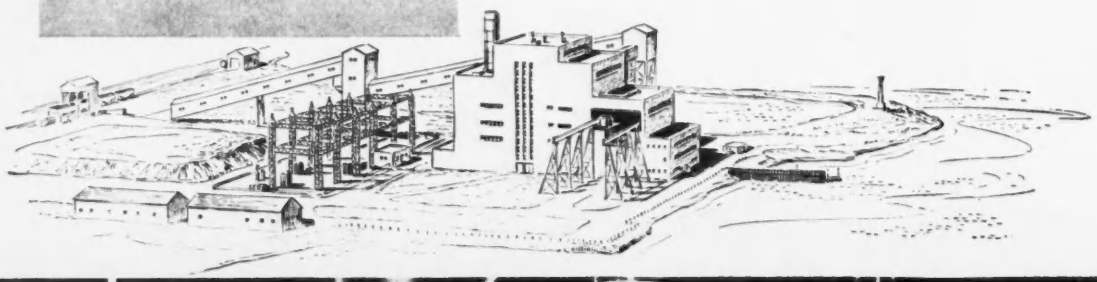
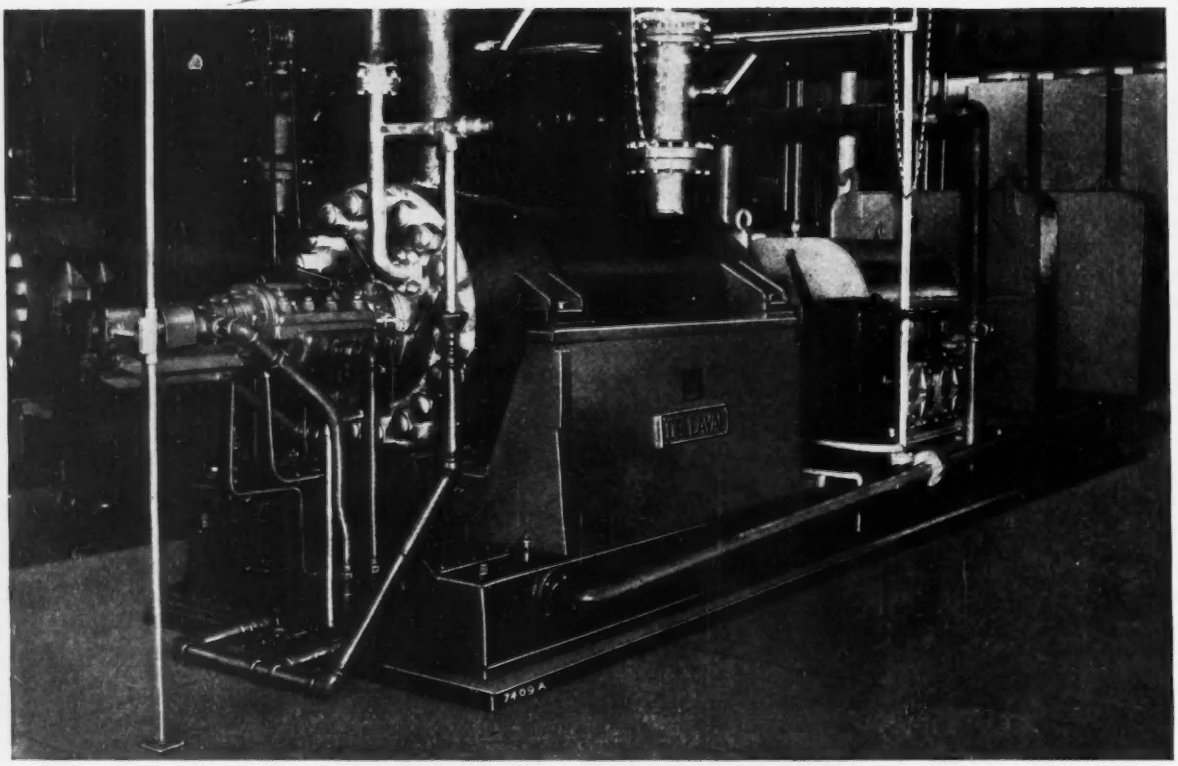
BARREL TYPE
BOILER FEED PUMPS

on the job at Danskammer Point





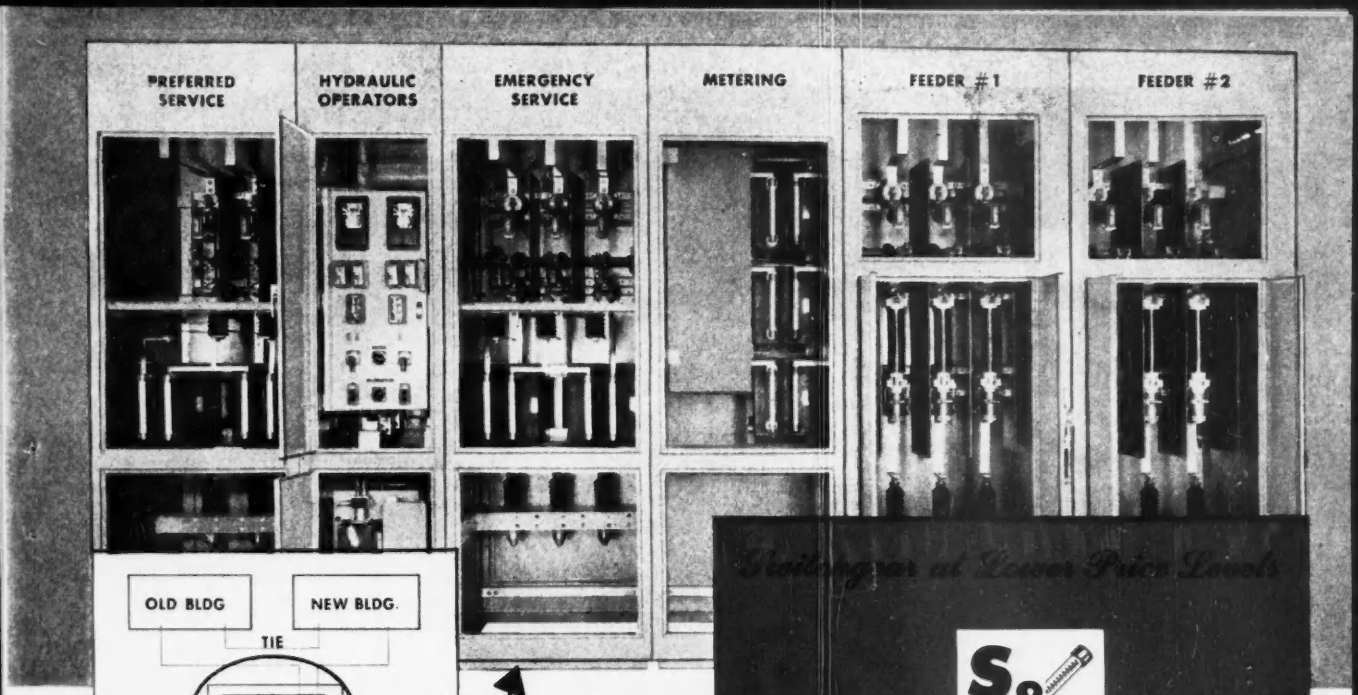
These two De Laval 11-stage barrel type boiler feed pumps are now helping to produce power for the Danskammer Point Steam Station of the Central Hudson Gas and Electric Corporation. Both pumps, one of which is used for standby service, are sized for full boiler load and will deliver 1,400 gpm of 326F water against 2,155 psig discharge pressure. Two more same size De Laval pumps have already been ordered for the second main unit of the Danskammer Station.

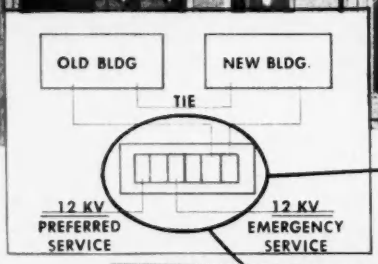
De Laval barrel type boiler feed pumps meet all the requirements of high pressure boiler feed service. They can be thrown on the line quickly without long preliminary warming up. They are not affected by sudden temperature changes. The distinctive De Laval design assures years of reliable service with minimum maintenance.

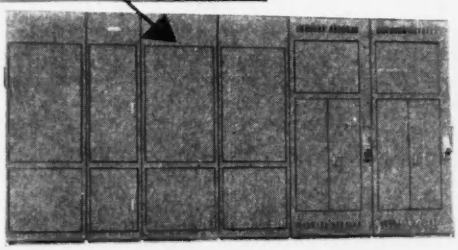
DE LAVAL *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY
Nottingham Way, Trenton 2, New Jersey

DL 175







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●

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Nearly always it affords the lowest cost way to a thoroughly reliable switching center or service entrance unit. Write for full information today.

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Company_____

Address_____

City_____ Zone____ State_____

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Giant strides for modern communications! For 500 miles on the El Paso Natural Gas Pipeline Philco microwave averages fifty miles between repeater stations.

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In this rugged, mountainous country, plagued by wind and snow, this entire communications and control system rests on Philco quality equipment. Philco microwave meets Joint Army and Navy specifications wherever applicable and is relied upon by the nation's leading pipelines, railroads, utilities and common carriers.

For reliability, economy and flexibility look to Philco microwave.

For full information write to Department EW

PHILCO CORPORATION

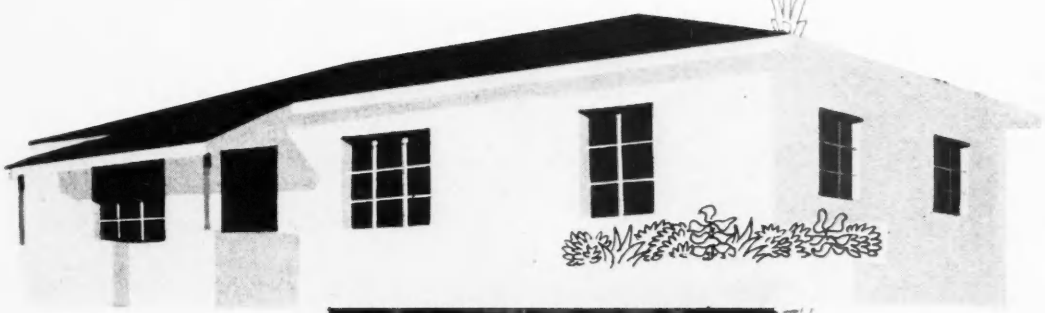
GOVERNMENT & INDUSTRIAL DIVISION · PHILADELPHIA 44, PENNA.

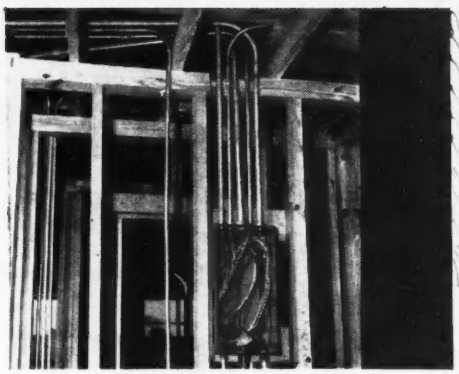
Over 200,000 feet of

SPANG® EMT

thin wall conduit with the

SPANGLEAM finish installed in Miami Housing Project





The damp, salty atmosphere and year-around high temperatures of Southern Florida climate place high requirements on the type of EMT thin wall conduit used in construction of new homes and buildings.

For this reason, 205,000 feet of Spang's new EMT thin wall conduit with the SPANGLEAM finish was chosen for use in wiring the new 350-unit housing project at Miami, Florida . . . because the new SPANGLEAM finish, inside and out, assures high corrosion resistance and years of service life.

Specially finished inside with a protective coating of resinous lacquer compounded with Zirconium, SPANGLEAM provides easier wire pulling, assured grounding and corrosion resistance.

Spang top-quality EMT conduit is easy to cut, bend and install . . . it's cleaner, easier to handle, easier to maintain. Ask *any* electrical contractor . . . he'll tell you *why* SPANG EMT thin wall conduit is better!

Spang EMT with the SPANGLEAM finish is available *at no extra cost* immediately in a full range of sizes from ½ inch to 2 inches. See your distributor today—ask for SPANGLEAM.

Owner and General Contractor:
Ricmar Builders, Inc.

Architect:
Thomas J. Madden, Jr.

Electrical Contractor:
Tri-City Electric Company, Inc.

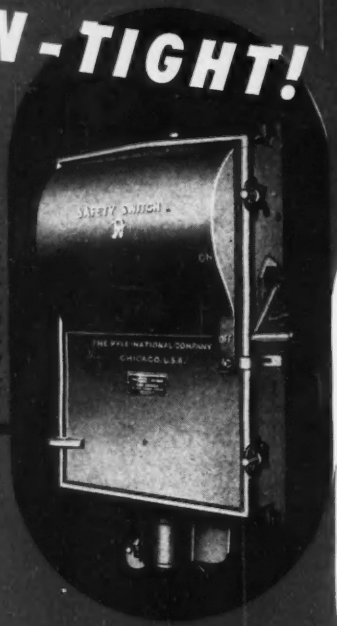
SPANG CONDUIT

SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE:
PITTSBURGH 30, PA.
District Offices and Sales Representatives
in Principal Cities

Heavy Duty Safety Switch, and Circuit Breaker

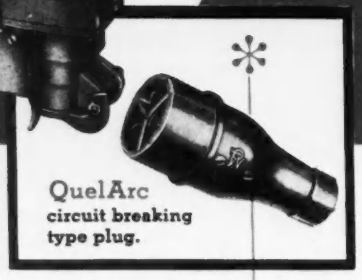
RAIN-TIGHT! DUST-TIGHT!

RAIN-TIGHT SAFETY SWITCHES with receptacle, fusible or fusetron, ratings up to 100 amps. 802 volts . . . without receptacle, up to 200 amps. 800 volts. (NEMA TYPES V, IV and III)



DUST-TIGHT AND RAIN-TIGHT CIRCUIT BREAKERS with receptacle, ratings up to 100 amps. 600 volts . . . without receptacle, up to 225 amps. 600 volts. Dust-tight types for hazardous locations, Class II, group E, F, and G. (NEMA TYPES IX, V, IV and III)

PYLETS



QuelArc circuit breaking type plug.

Designed for Safe, Reliable Operation and Protection of Portable and Stationary Electrical Equipment, indoors and outdoors, under the most severe operating conditions

MUCH LONGER SERVICE LIFE AND LOWER MAINTENANCE COSTS insured by heavy, rust-resisting cast metal construction and rain-tight gasket seals.

COMPLETE SAFETY FOR THE OPERATOR is provided by safety circuit grounding and the interlocking of door and plug receptacle with a quick make and break switch mechanism.

Consult your Pylet Catalog, Bulletin 1150 for complete listings.

PYLE QuelArc plugs, used with this equipment, are well known industrially, for their unique partitioned construction. Long insulating surfaces from pole to pole, and from poles to ground provide for exceptionally safe handling and long service life.

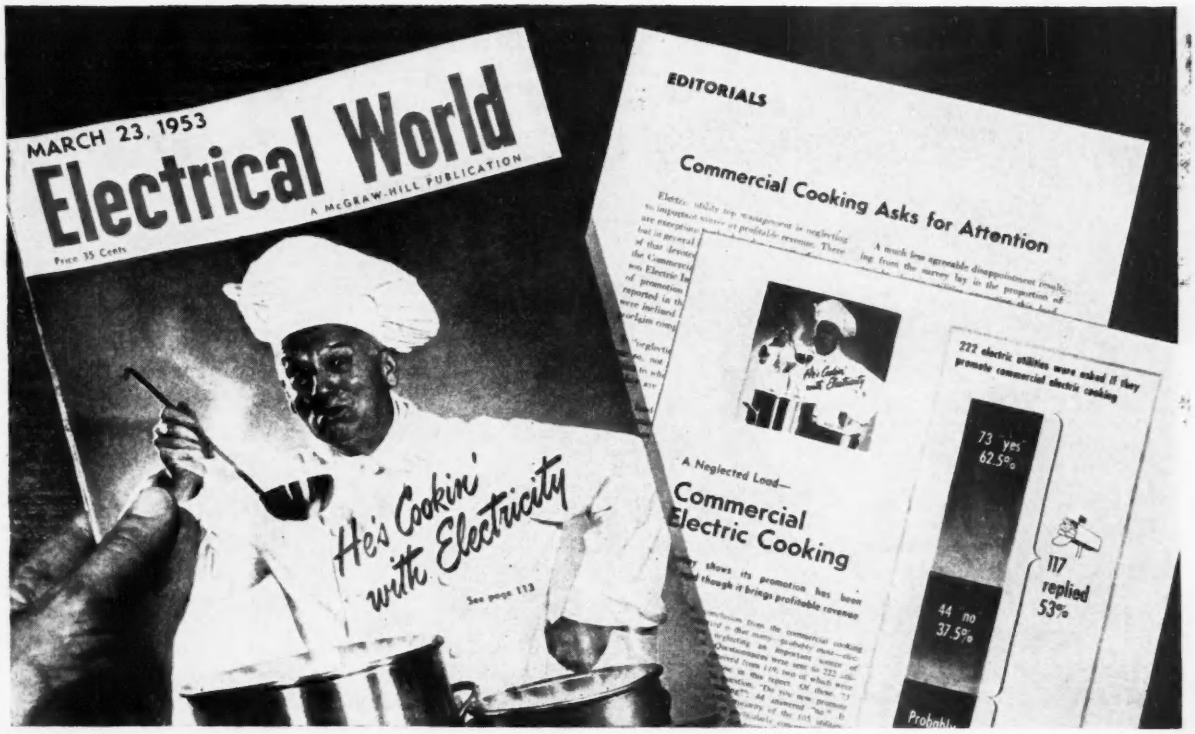
SINCE 1897

THE PYLE-NATIONAL COMPANY

1385 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS

District Offices and Representatives in Principal Cities of the United States
Export Department: International Railways Supply Co., 30 Church St., New York.
Canadian Agent: The Holden Co., Ltd., Montreal.

PLUGS AND RECEPTACLES • FLOODLIGHTS • TURBO-GENERATORS • GYRALITES • CONDUIT FITTINGS • MULTI-VENT AIR DISTRIBUTION



Electrical World "lays it on the line"—

"Electric Utility Top Management is Neglecting an Important Source of Profitable Revenue"

So say *Electrical World* editors in their March 23rd issue, which published the findings of their survey of utility commercial cooking promotion. Read what else they had to say:

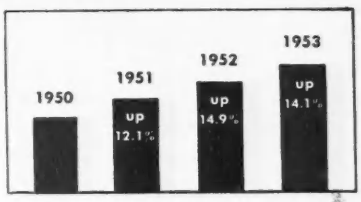
"Is 'neglecting' too strong a word? It does not seem so, not when less than one third of the utilities to whom the survey form was sent reply that they are promoting this load.

"Is this load a 'source of profitable revenue'? Taking demand and coincidence factors into account, the average of over $20 annual revenue per kilowatt of connected load . . . replies must mount up to a very happy figure relative to cost of system capacity required."

The editors conclude, "If commercial cooking were a difficult load to sell, if the cost of its acquisition were high in relation to its revenue potential, one could understand why it is not getting the attention it deserves. But it is not too hard to sell; and as the survey report shows, its annual revenue stacks up excellently against its sales expense."

Excerpts (at right) from *Electrical World's* survey prove just how fabulous a revenue-builder commercial cooking is—how comparatively little sales expense is needed to build it.

Why let this opportunity pass you by? Mail the coupon now for Hotpoint's proved promotion programs which have brought success to scores of utilities in building commercial cooking revenue.



"PROMOTION OF COMMERCIAL COOKING BUILDS DESIRABLE LOAD FAST,"
says *Electrical World*

Promotion pays off! Estimated connected load data received from reporting utilities shows a *12 to 15% annual increase*. These utilities now average *$½ million in added revenue* a year!

OTHER *ELECTRICAL WORLD* FINDINGS—

- EAR per dollar of sales expense averaged $14.44. EAR per kw of new commercial load averaged $25.72.
- "The load is good—it's even and to a large degree off-peak. And customer satisfaction is high."
- "Commercial cooking revenue rises faster (10 to 14% annually) than *total* industrial and commercial revenue (7.5% in 1952)."

Hotpoint Co., Commercial Equipment Dept.
227 South Seeley Ave., Chicago 12, Illinois

☐ Please send me a reprint of Electrical World's article on commercial cooking.
☐ Please send me details of Hotpoint's commercial cooking promotion program.

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ STATE_____

Hotpoint ALL-ELECTRIC Commercial Cooking
HOTPOINT CO., A Division of General Electric Company

Part of the 60-cell DME-17C Exide-Manchex installation at Texas Power & Light Company's Norwood Substation, Irving, Tex.

Switchyard of Norwood Substation. Switchgear operated by Exide-Manchex batteries.

AGAIN IT'S EXIDE AFTER 27 YEARS ON THE JOB

Exide-Manchex BATTERY

Long life is an outstanding Exide quality . . . proved by one utility after another. Again it is shown by the Exide life record at Texas Power & Light Company's Norwood Substation—27 years and 8 months of dependable service. Now the choice is another Exide, a greater-than-ever Exide, the new Exide-Manchex battery which assures:

POSITIVE OPERATION: Dependable performance at ample voltage with no switchgear failures.

INSTANTANEOUS POWER: High rates for switchgear operation with adequate reserve power for all other control circuits and for emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COST: Water required about twice a year. No change of chemical solution during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding.

• • •

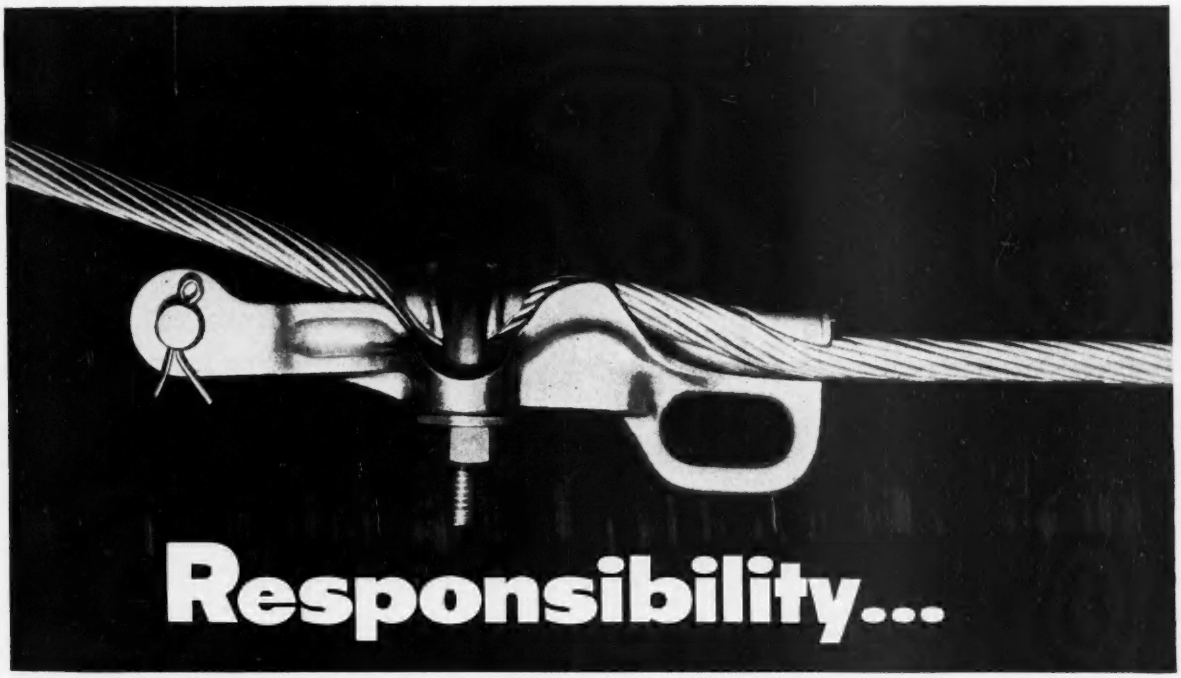
Various sizes and types of Exide Batteries are available in plastic containers.

Exide-Manchex is your best battery buy for all control and substation services.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 2
Exide Batteries of Canada, Limited, Toronto

"Exide" and "Manchex" *Reg. T. M. U.S. Pat. Off.*

1888 . . . DEPENDABLE BATTERIES FOR 65 YEARS . . . 1953



and a popular anchor clamp

Growing demand for a small, convenient clamp for all-aluminum cable in urban distribution lines brought the response to be expected from Alcoa.

The newest Alcoa anchor clamp, cast from tough aluminum alloy, handles limited tensions up to 2,500 pounds on 4/0 cable and 3,000 pounds on 336,400 cm cable, while the clamp provides tensile strength of 5,000 pounds between pin and pulling eye.

By developing two unique features, Alcoa engineers were able to evolve a single U-bolt design lending itself to rapid, easy installation. One of these is the three-point, graduated snubbing effect. The other is the U-bolt, itself. It matches the coefficient of expansion of both clamp and conductor. Its flattened cross section where it bears on the keeper avoids high stress concentration. Its fine threading permits high pressure to be developed without excessive manual effort.

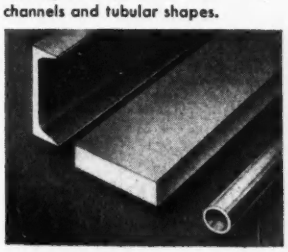
This new addition to a growing accessory line is another example of Alcoa responsibility in action to help insure the best service from the best product. A responsibility undertaken more than 55 years ago when Alcoa introduced aluminum electrical conductor and still hard at work today for you. Aluminum Company of America, 2100-T Alcoa Building, Pittsburgh 19, Pennsylvania.

Alcoa Aluminum

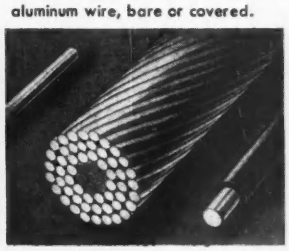
ALUMINUM COMPANY OF AMERICA

"SEE IT NOW" with Edward R. Murrow —CBS-TV every Sunday . . . brings the world to your armchair. Consult your newspaper for local time and channel.

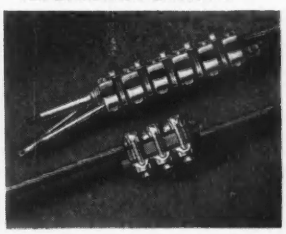
Alcoa Aluminum Bus is available in rectangular and solid round bars, channels and tubular shapes.



Alcoa Aluminum Electrical Conductors include ACSR, solid and stranded aluminum wire, bare or covered.



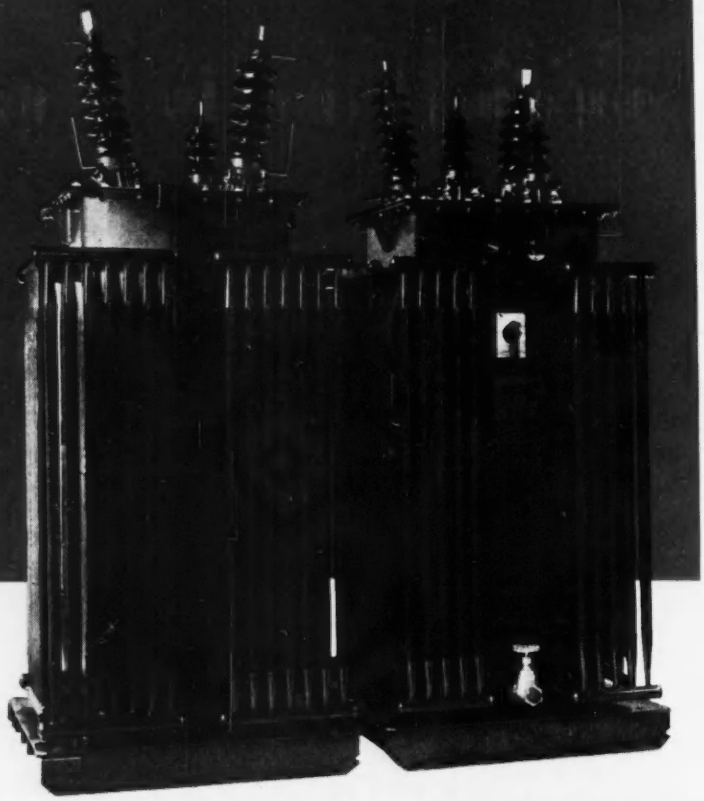
Alcoa's full line of aluminum accessories is correctly designed for use with all aluminum conductors.



UPTEGRAFF DISTRIBUTION TRANSFORMERS

SEALED TANK CONSTRUCTION

means longer-life low maintenance



Tight sealing that prevents "breathing" and the entrance of moisture, prolongs the service life of Uptegraff Transformers. Oxygen and moisture are found to be the principal causes of oil deterioration. All flanges and openings are so effectively sealed, that even the keen perception of the super-sensitive electronic Leak Detector does not find any sign of leakage.

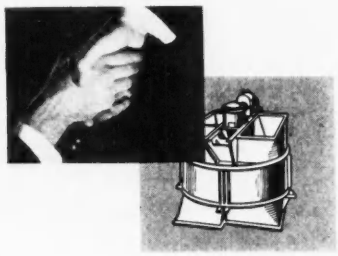
This is only one of many features that give Uptegraff Transformers exceptionally long life expectancy, and reduce maintenance costs.

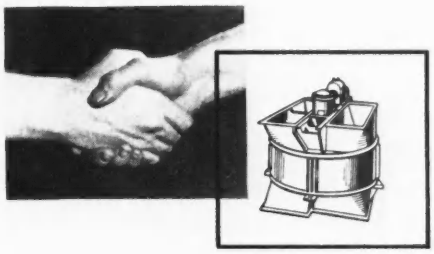
Uptegraff makes distribution transformers in all commercial ratings, from 3 KVA to 500 KVA, and in a complete series of dry type air-cooled designs, as well as the liquid-filled units.

Every liquid-filled Uptegraff Distribution Transformer is checked by the electronic Leak Detector before shipment. The photograph above shows front and rear views of a single phase, 60-cycle, 26,400–13,100Y/7560 volts, 500 KVA transformer.

R. E. UPTEGRAFF MANUFACTURING COMPANY

Scottdale, Pennsylvania





Why your Ljungstroms are so efficient

—year after year

Air Preheater Corporation Field Engineers aim to visit every Ljungstrom Air Preheater in this country at least once a year. Their main objective is to increase availability and assure you a maximum return on your investment. They are always available for consultation.

This is just another reason why the Ljungstrom Air Preheater is *the most economical heating surface on the modern boiler.*

THE AIR PREHEATER CORPORATION

60 East 42nd Street
New York 17, N. Y.

ALLIS-CHALMERS

OIL CIRCUIT BREAKERS

NEW

Here's the inside story of recent improvements in this time-proved breaker. This breaker has long been used for outdoor distribution service where safe, reliable operation is a necessity. Now it is even more easily installed and maintained. This means a further reduction in your circuit breaker service costs because of the following features. A-4074

1. New "full view" doors open to expose three sides of operator cabinet—not just one.
2. Gasketed doors make cabinet completely weatherproof.
3. Cabinet is enlarged to house accelerating adjustment mechanism, solenoid operator and connecting linkage. Accelerating spring is easily accessible.
4. Simplified operator and pole unit mechanisms. Fewer parts now used for simplicity — added reliability.
5. Maintenance closing handle can be used from either front or side of control cabinet. This means breaker may be used in confined area.
6. Shielded vitreous enameled space heater provided.
7. Manual trip now located higher on back of cabinet to help prevent accidental tripping.
8. Simplified transformer wiring duct. Removal of single bottom plate of wiring duct exposes continuous transformer leads along full length of duct.
9. Self-aligning tulip and bayonet contacts retained.
10. Contacts are at convenient level — no interference from the frame.
11. Thoroughly proved *Ruptor* arc-interrupting device retained.
12. Easy tank removal! There is no interference from frame.
13. Individual rectangular tanks occupy less space, using less oil and providing best electrical clearances.
14. Tank lifter mounted on back — operated from either side.
15. Grounding pad is stainless steel faced.

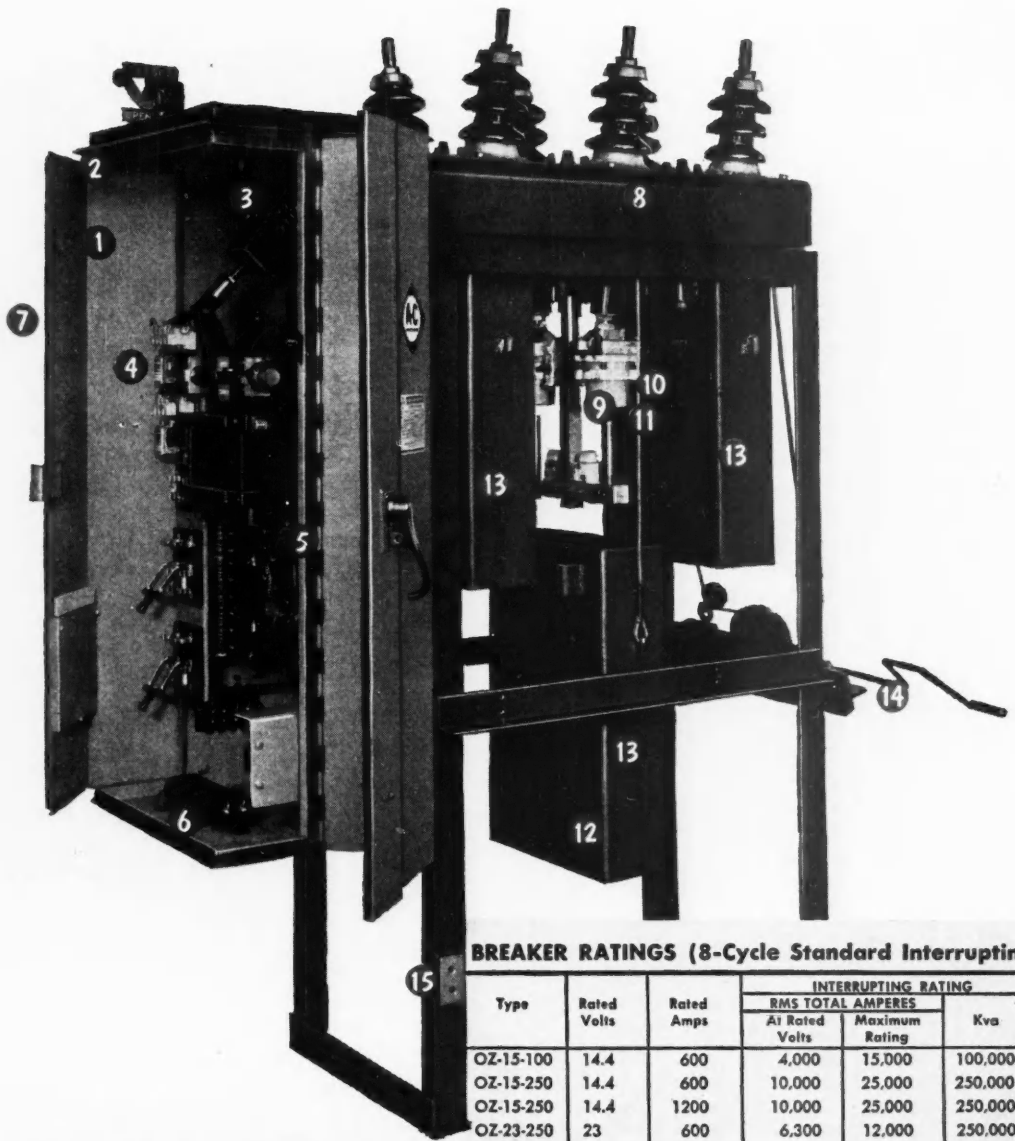
Standard outdoor automatic reclosing relay equipment and cabinet are available.

Ruptor is an Allis-Chalmers trademark.

ALLIS-

Accessibility

For Inspection...Test...Maintenance



BREAKER RATINGS (8-Cycle Standard Interrupting Time)

Type	Rated Volts	Rated Amps	INTERRUPTING RATING RMS TOTAL AMPERES At Rated Volts	INTERRUPTING RATING RMS TOTAL AMPERES Maximum Rating	Kva	Weight of Breaker With Oil (lbs)
OZ-15-100	14.4	600	4,000	15,000	100,000	2,350
OZ-15-250	14.4	600	10,000	25,000	250,000	2,370
OZ-15-250	14.4	1200	10,000	25,000	250,000	2,470
OZ-23-250	23	600	6,300	12,000	250,000	2,370

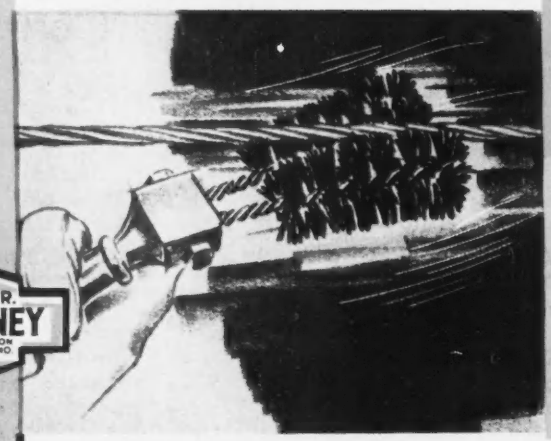
CHALMERS

A-C ALLIS-CHALMERS

HOW TO MAKE *A Better Joint* FOLLOW THESE

1

CLEAN the conductors with the *Kearney Cleaning Brush*. Specially designed to clean deep down between strands, this easy-to-use brush removes every trace of corrosion with just a few short strokes; provides a high conductivity transfer surface. The *Kearney Cleaning Brush* is available with sure grip handles or with fit-on head for hot stick use.



2

PROTECT the cleaned surface with *KEARNALENE Corrosion Inhibitor*. *Kearnalene* chemically stops corrosion before it has a chance to start. It's handy to apply; will not harm the skin or damage conductors.

Kearney

JAMES R. KEARNEY CORPORATION

4224-42 Clayton Ave., St. Louis 10, Mo. • *Canadian Plant:* Guelph, Ontario

GOOD CONNECTIONS ARE A VALUABLE INVESTMENT

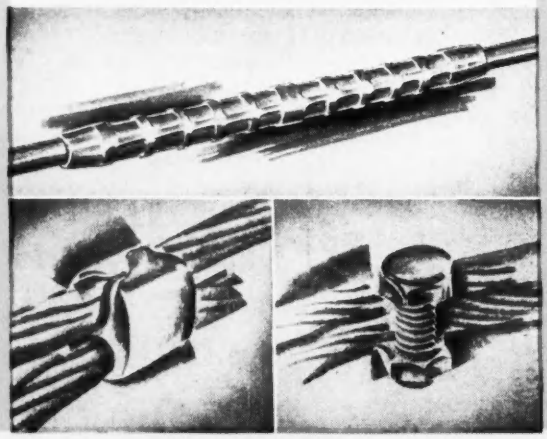
By making these four simple operations standard practice on every connection, you can depend on your connections to remain tight and trouble-free... yet easy to remove if necessary. You'll be saving yourself money and manpower for months and years to come.

Write Dept. A today for complete information on any or all of these System-Saving Kearney Products.

FOUR OPERATIONS

3

SELECT the right *Kearney Connector* for the job. A wide range of types and sizes provides economy and efficiency to meet every requirement:
Con-Nec-Tite Split Bolt Connectors
Squeezon Compression Connectors
Pressurite Two Bolt Clamps
Parallel Groove Clamps
Laptite Service Entrance Connectors
High Conductivity Splicing Sleeves



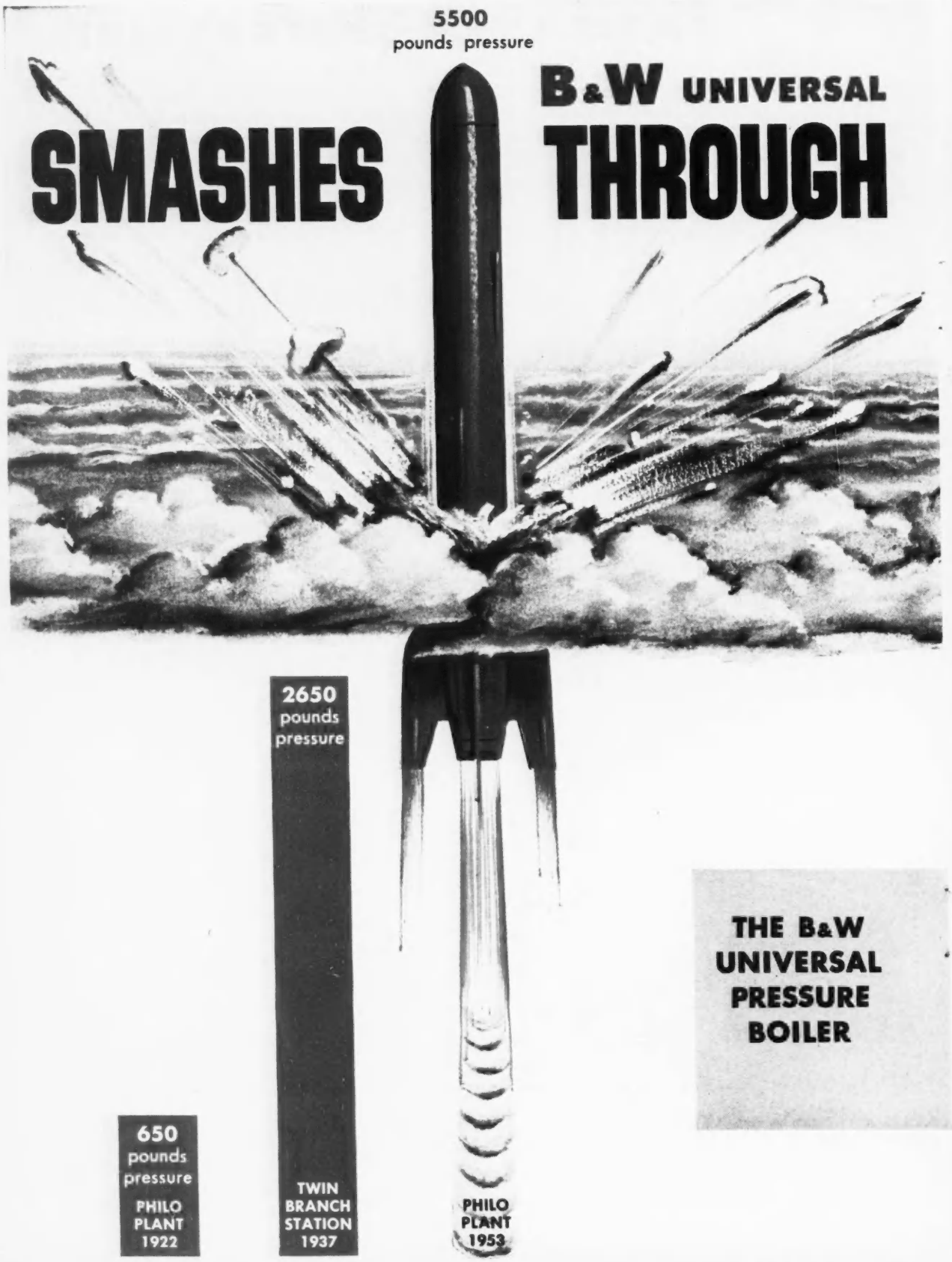
4

SEAL the connection permanently against air and moisture with *Kearney Airseal*. When kneaded around the connection, this high-dielectric compound forms a pliable, removable seal which prevents galvanic action in bi-metallic joints or oxidation in any connection. *Airseal* is supplied in 5 sizes of pads or rolls for fast, easy application.

PRODUCTS

For Better Construction... for **SAFER** *Maintenance*

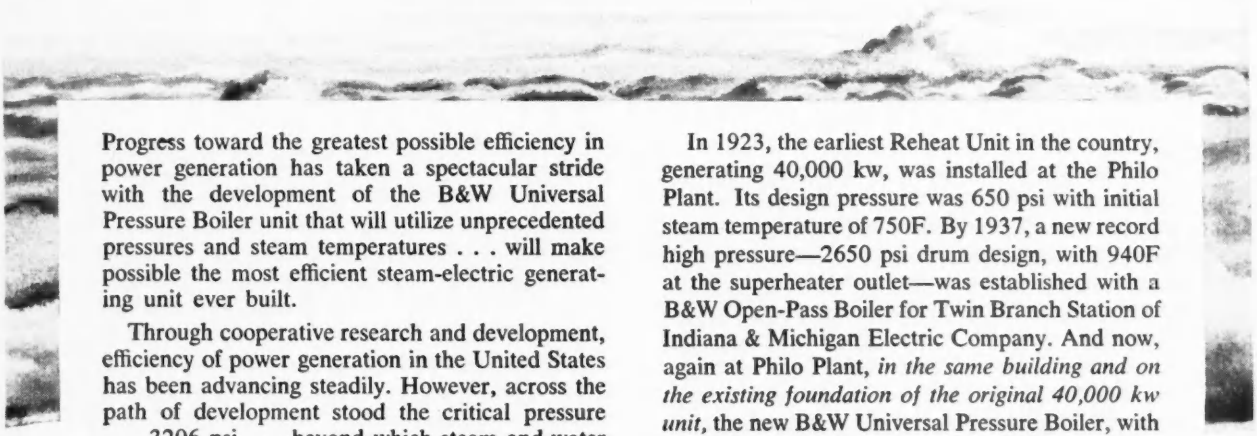
JRK-235


5500
pounds pressure
B&W UNIVERSAL
SMASHES THROUGH
2650
pounds
pressure
650
pounds
pressure
PHILO
PLANT
1922
TWIN
BRANCH
STATION
1937
PHILO
PLANT
1953
THE B&W
UNIVERSAL
PRESSURE
BOILER

PRESSURE BOILER

THE PRESSURE CEILING

To bring new efficiency levels in steam-electric generation



Progress toward the greatest possible efficiency in power generation has taken a spectacular stride with the development of the B&W Universal Pressure Boiler unit that will utilize unprecedented pressures and steam temperatures . . . will make possible the most efficient steam-electric generating unit ever built.

Through cooperative research and development, efficiency of power generation in the United States has been advancing steadily. However, across the path of development stood the critical pressure . . . 3206 psi . . . beyond which steam and water could no longer be separated. If further important economies were to be achieved, this barrier had to be broken. Only by going to pressures far beyond anything being used could new and broader avenues to greater economy be opened. This is the significance of the Universal Pressure Boiler and the new turbo-generator installation for the Philo Plant of the Ohio Power Company.

In 1923, the earliest Reheat Unit in the country, generating 40,000 kw, was installed at the Philo Plant. Its design pressure was 650 psi with initial steam temperature of 750F. By 1937, a new record high pressure—2650 psi drum design, with 940F at the superheater outlet—was established with a B&W Open-Pass Boiler for Twin Branch Station of Indiana & Michigan Electric Company. And now, again at Philo Plant, *in the same building and on the existing foundation of the original 40,000 kw unit,* the new B&W Universal Pressure Boiler, with a turbo-generator operating at 4500 psi and 1150F, will produce 120,000 kw, in the same space and using 45% less fuel per kilowatt-hour.

Smashing through the pressure ceiling—3206 psi—is a culminating achievement typical of the imaginative daring which has marked previous advances in economy of steam-electric generation. It opens a new era for the American utility industry.

The new B&W UNIVERSAL PRESSURE BOILER will be of the once-through type in which water at 5500 psi will be pumped through and changed into superheated steam in a single fast passage through the boiler tubes. Steam at 4500 psi and 1150 F—almost double the current highest steam pressure and 50 F above the present highest temperature—will spin the specially designed turbo-generator.

Two stages of reheat will be employed in the boiler—the first at 1150 psi and 1050 F and the second at 165 psi and 1000 F—and it will be equipped with three B&W CYCLONE FURNACES to assure most rapid and complete combustion of the coal, with minimum maintenance and greatly reduced fly ash discharge from the stack.

The Universal Pressure Boiler accomplishes two vital savings:

1. By eliminating the steam drum and making possible a completely new concept of arranging heat absorbing surfaces, building requirements and erection costs will be materially reduced, bringing important savings in initial investment.

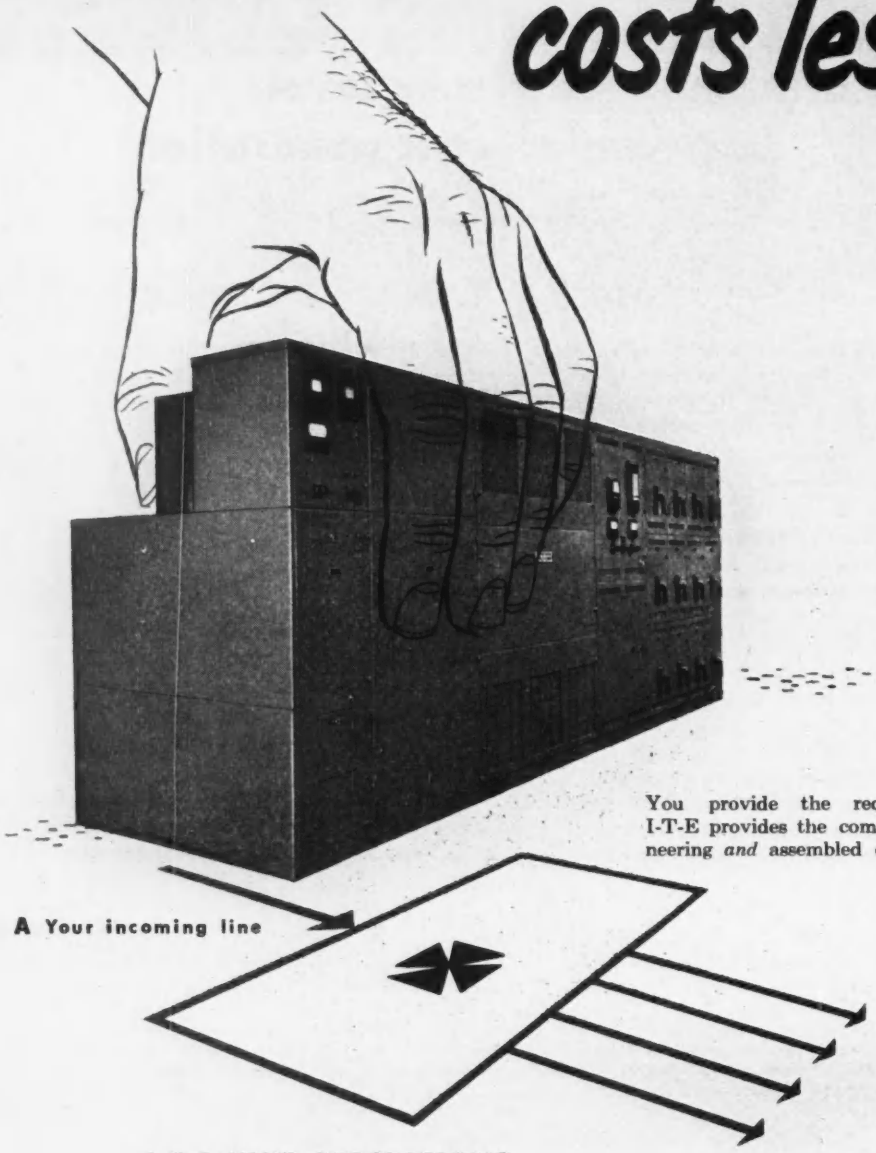
2. Radical reduction in fuel consumption through the use of a highly efficient steam cycle.

BABCOCK & WILCOX

BOILER DIVISION

G-614

COMPLETE ENGINEERING *costs less!*



You provide the requirements. I-T-E provides the complete engineering *and* assembled equipment.

I-T-E UNIT SUBSTATIONS

are available in all required ratings, indoor or outdoor, for every service condition. Substations include primary air circuit breakers or interrupter switches, transformers (oil-filled, askarel-filled, air-cooled, or nitrogen-sealed), and secondary air switchgear.

I-T-E Unit Substations for modern plant distribution

Modern plants require the utmost in power distribution efficiency, reliable circuit protection, service continuity, safety, and economy.

Unit Substations—integrated units of stepdown transformers and protective switchgear for location at load centers—have been an I-T-E specialty for many years.

Over-all responsibility

From the incoming lines to the outgoing circuits, I-T-E supplies all the equipment you need—completely coordinated as a package. Furthermore, I-T-E assumes full responsibility—from initial planning, through manufacture, to shipment. Factory-assembled and -tested, *complete* unit substations are delivered ready for installation.

Quality throughout

I-T-E's experienced staff of switchgear engineers assures you professional competence in the selection and application of all components to fit each job. The proved quality of I-T-E products is your guarantee of uniform, outstanding performance, long life, and over-all economy.

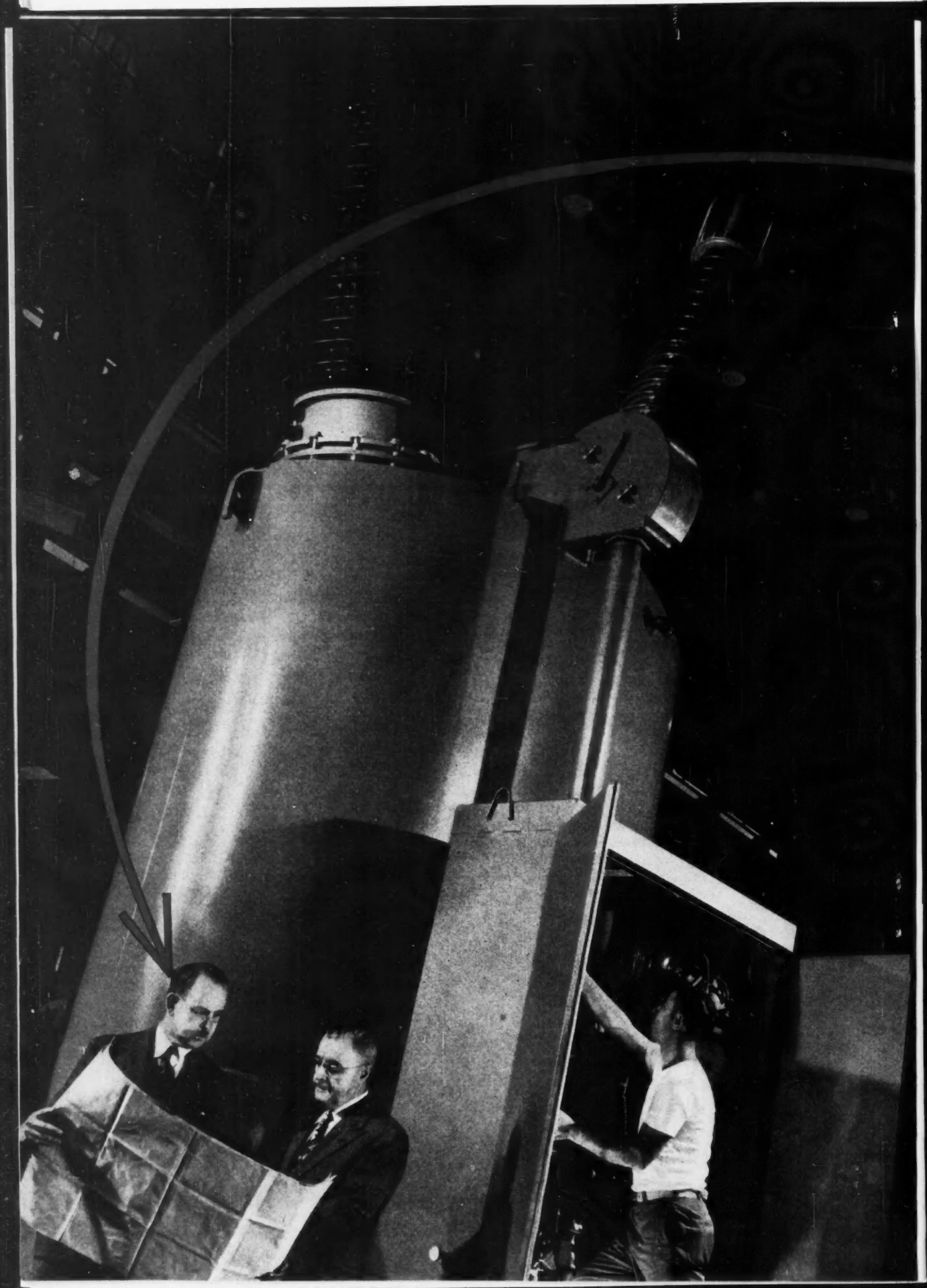
See how much I-T-E COORDINATED PLANNING can save you!

There is an I-T-E Application Engineer near you. He will assist you with your specific requirements—and show you how you can save with *complete* I-T-E engineering. Give him a call. *I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.*

I-T-E

UNIT SUBSTATIONS

for every application



He's your man

WHO IS HE?

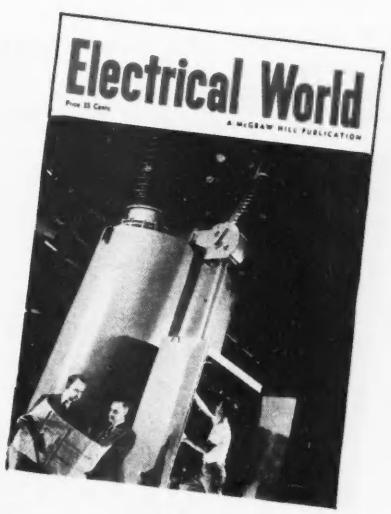
For one thing, in the electric power industry, he's known as a big spender . . . likes to spread his money around in large amounts. This year, for example, he'll write checks totaling more than four *billion* dollars . . . will better that each year for at least the next four. And he'll spend his money on practically everything under the sun – trucks, transmission cable, typewriters and turbines to mention only a few items.

Sound like a person you'd like to meet?

He's available – every Monday morning – and Electrical World will be delighted to arrange an interview. You see, he's one of the more than 23,000 paid subscribers who read Electrical World each week . . . who depend upon Electrical World for the latest news and technical information to help them do their jobs.

Whether he works for a utility company, big industry, an electrical manufacturer, or as an electrical engineering consultant, you can reach *your man* through the advertising pages of Electrical World . . . the publication voted most useful by industry men by a four to one margin* over any other electrical magazine.

Yes, if you sell a product or service to the great electric power industry, *he's your man* . . . and you can reach him best . . . tell him your product story best . . . if you tell him in . . .



* Proven by independent readership studies conducted by electrical manufacturers over their own lists of customers and prospects.

Electrical World

Where the electric power industry gets its information . . . and gets it first!

ABP

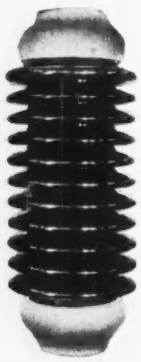
A McGraw-Hill Publication, 330 West 42nd Street, New York 36, New York

ABC

PROBLEM: Industrial Contamination

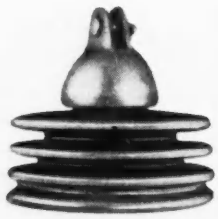
LAPP LINE POST

"All-time champion" among transmission insulators in point of service dependability at duty up to 69 kv. Its record, both on new construction and after reinsulation of lines to higher voltages, has been built on ability of Line Post to avoid leakage flashover, to withstand lightning arcover and mechanical attack, its inherent freedom from puncture and cracking.



LAPP STATION POST

In addition to the superior electrical and mechanical characteristics inherent in Lapp Post design, Station Posts also possess extra rigidity. Cap and base are externally attached for large-area low-intensity compression loading of porcelain, as contrasted to small-area, high-intensity loading of nested porcelain and metal parts in conventional pin-cap switch insulators.



LAPP FOG-TYPE SUSPENSION INSULATOR

For high-voltage lines in areas of severe contamination—salt fog, industrial fumes, or dust—Lapp Fog-Type suspension units provide maximum leakage distance per length of string—and for greater effectiveness of leakage distance, inch for inch.

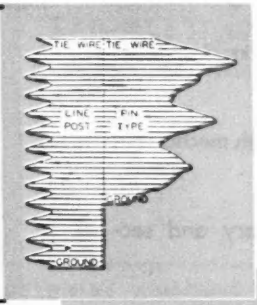
SOLUTION:

Lapp Fog-Type Design

Service dependability on lines subjected to severe contamination . . . industrial smoke and fumes, dust, or salt fog . . . can be assured—without frequent cleaning of insulators—and without danger of failure from leakage flashover. Lapp Fog-Type design provides superior performance for transmission, switch and bus support because of two basic superiorities of design principle . . .

1. UNIFORM LEAKAGE PATH

Leakage flashover results from a contaminated surface which is not uniform—wet areas lower total resistance, so increase leakage current until voltage flashes over narrow shielded areas, precipitating flashover of entire unit. Compare developed uniform leakage surfaces of 66 kv Line Post (on left side) with that of conventional pin-type (right) where variation in conductivity is 3.6 times as great.



2. SELF-CLEANING

Under heavy rain and wind, contamination rapidly flushes away. Fog-Type petticoats are so shaped and spaced that rain falling on one petticoat splashes and cleans the under side of the one above. Resistance increases, leakage current falls—uniformly and over entire unit.

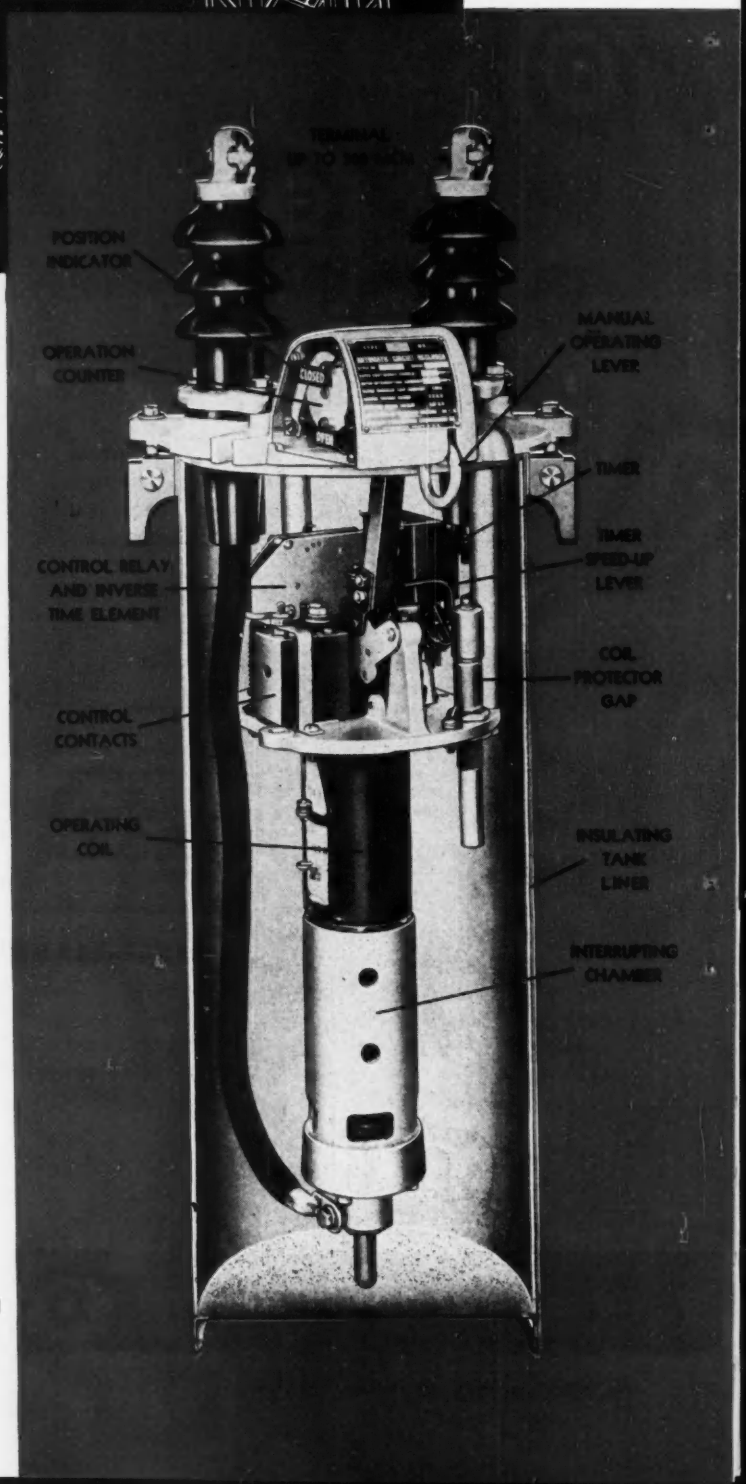
Lapp

LAPP INSULATOR COMPANY, INC., LEROY, NEW YORK

R&IE POWER CLASS

Save Money—
with
ECONOMICAL PROTECTION

1. Reduces service costs by preventing unnecessary fuse blowing.
2. Provides full protection to wires and equipment.
3. Greater accuracy through mechanical timing.
4. Coordinates with primary and secondary fuses.
5. Permits normal fusing for selective clearing of overloads and short circuits.
6. Selects with substation overcurrent relays.



TYPE MB-1
(shown)

RECLOSERS up to 280 Amperes continuous duty

Bring you Transmission type service for your Distribution System — *Substations and Lines.*

Check the Facts —

1 High interrupting capacity - up to 6,000 amperes!

2 Load currents - 100, 140, 200 and 280 Amp.

3 Insulated Housing - can be grounded.

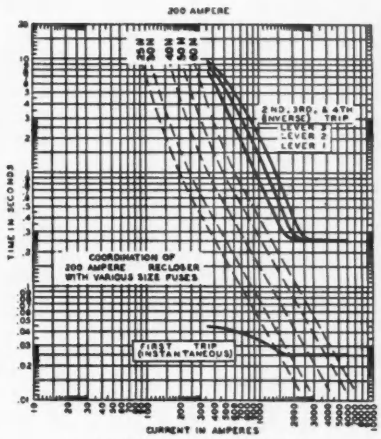
4 Improved fuse coordination - "lightning fast" (1½ cycle initial tripping) followed by -

5 Selective delayed subsequent tripping (adjustable inverse time, or adjustable definite time).

6 Quick reset from lockout. Trip-free reset lever.

7 Improved precision mechanical timer - free from temperature error.

8 Mechanism can be mounted in tank in any angular position in 60 degree steps.



High Fidelity TIME CURRENT CURVE

Ratings —

INTERRUPTING RATINGS IN RMS SYMMETRICAL AMPERES

The Recloser will also interrupt the maximum asymmetrical current on a distribution circuit for which the symmetrical fault current does not exceed these ratings.

Type MB-1			Type MBH	
Continuous Duty Rating of Recloser in Amperes	Service Voltage 2.4 Kv	Service Voltage 7.2 Kv	Continuous Duty Rating of Recloser in Amperes	Service Voltage 14.4 Kv.
100	4000 Amps.	4000 Amps.	100	2000
140	5000 "	4000 "	140	2000
200	6000 "	4000 "	200	2000
280	6000 "	4000 "	280	2000

More Information — Complete Information is available.

For details write:

R&IE EQUIPMENT DIVISION
I-T-E Circuit Breaker Co.
GREENSBURG, PENNA.

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

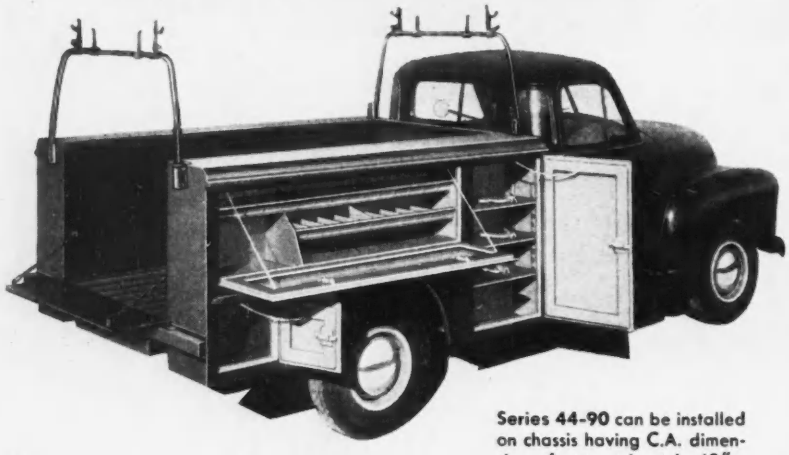
KIRK INTERLOCK SYSTEMS

AUTOMATIC RECLOSING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

5 Ways to Speed Up Your Service Work



Series 44-90 can be installed on chassis having C.A. dimension of approximately 48″

Series 44-75 for chassis having approximately 40″ C.A. dimension.

Series 44-104 for single or dual rear wheel chassis having 60″ C.A. dimension.

Series 44-L-90 for chassis having approximately 48″ C.A. dimension.

Series 44-L-104 for 60″ C.A. chassis having single or dual rear wheels.

POWERS American AGB

SERIES 44 and 44-L

SERVICE AND MAINTENANCE BODIES

These five bodies have an impressive record for saving time and money on service jobs. Compartments are equipped to keep tools and supplies safe and orderly — easy to inventory before leaving for the job — easy to find upon arrival. The bodies are adaptable to a wide variety of service operations, and each model can be transferred to a new chassis when the original truck wears out. If you're looking for new ways to get more productive man hours, you'll want full information on Series 44 and 44-L bodies. Why not send for complete details . . . now?

Clip this coupon and attach to your letterhead!

McCABE-POWERS AUTO BODY CO., 5900 N. Broadway, St. Louis 15, Mo.
Please send me complete information on the following:

- ☐ Series 44-75
- ☐ Series 44-90
- ☐ Series 44-104
- ☐ Series 44-L-90
- ☐ Series 44-L-104
- ☐ Line Construction Bodies
- ☐ Revolving Aerial Ladders
- ☐ Hydraulic Towers
- ☐ .....

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State ..... ST

POWERS American AGB DIVISION

PUBLIC UTILITY BODIES & EQUIPMENT

McCABE-POWERS AUTO BODY CO.

MAIN OFFICE AND PLANT
5900 N. Broadway • St. Louis 15, Mo.

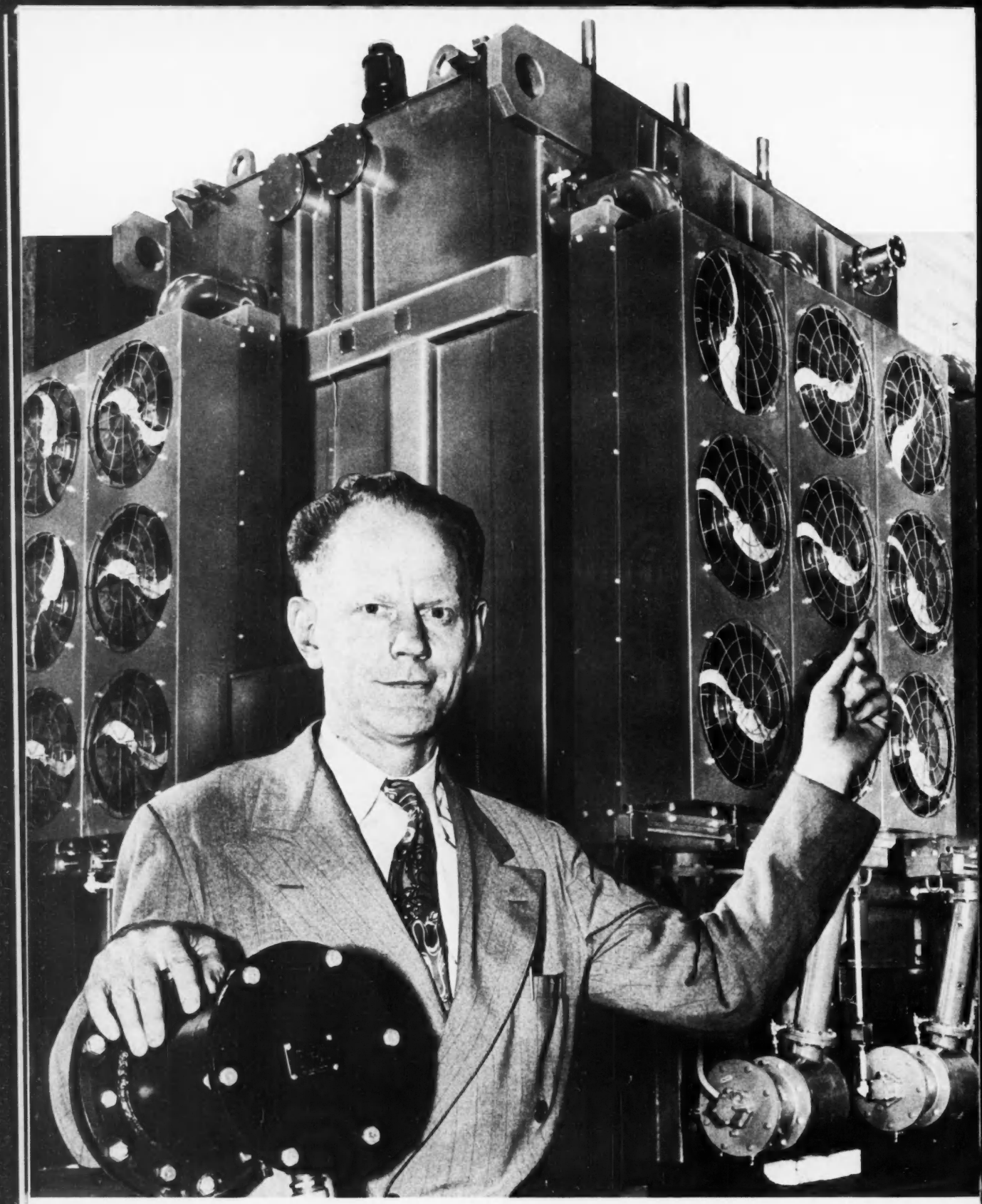
WESTERN OFFICE
Latham Sq. Bldg. • Oakland 12, Calif.

Meet J. E. Barkle

Westinghouse Electric Utility Engineer. On the next seven pages, Mr. Barkle discusses your electrical equipment in terms of . . .

Protecting against the threats to your transmission system

Jack Barkle works on general projects for Western utilities where transmission lines are long and problems are challenging. A 15-year veteran of the Westinghouse Electric Utility Department, he is an expert in the field and has authored numerous AIEE papers on high-voltage transmission.



YOU CAN BE **SURE**...IF IT'S

"Here's E. C. Wentz, Manager Large Transformer Engineering Development, pointing out an accessory development."

New sudden pressure relay nips trouble in the bud

Westinghouse power transformers can now be equipped with a new relay that provides the long-sought answer to the problem of detecting transformer faults before extensive damage results.

Mounted on the side of the tank opposite the gas space, the new relay is designed for alarm-trip circuit closing on the occurrence of an internal fault producing an abnormal pressure rise. It will detect rates of change even smaller than two ounces per square inch per second. For steep-front increases of 40 pounds per square inch per second it will operate in ½ cycle.

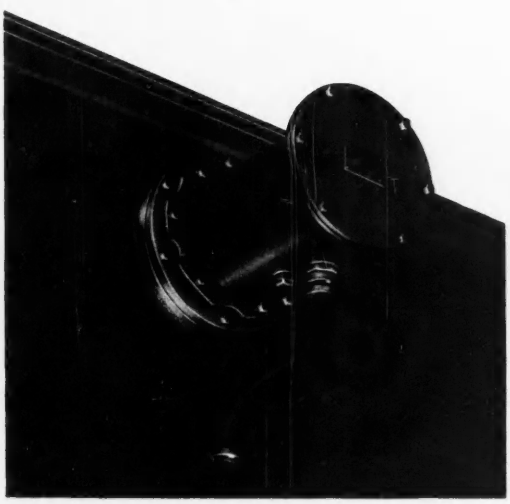
Disturbances such as inrush current, short circuits, impulse voltages or mechanical shock will not actuate the relay.

The relay operates by means of a pressure-actuated switch in a hermetically-sealed case which is isolated from the transformer gas space —except for a pressure equalizer. The equalizer permits normal transformer operation over its entire pressure range but throttles abnormal pressures to effect a pressure differential between the transformer and the relay case—thus operating the pressure switch.

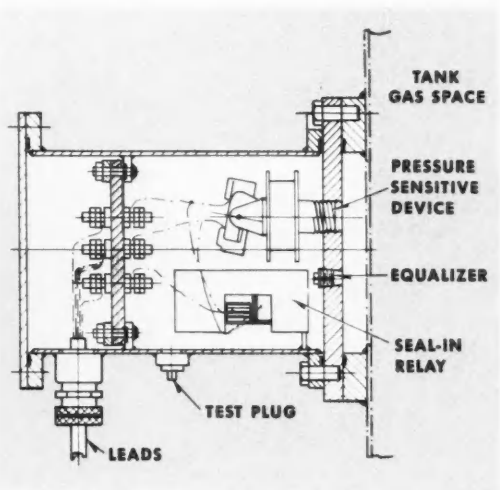
With such design improvements continually adding to Westinghouse power transformer protection, your transmission investment is assured of added reliability.

Why not investigate Westinghouse power transformers for application to your transmission system? You will find your nearby Westinghouse representative well-primed with helpful suggestions. Or write now for Booklet B-4142A, "Power Transformers for *All* Applications."

J-70696

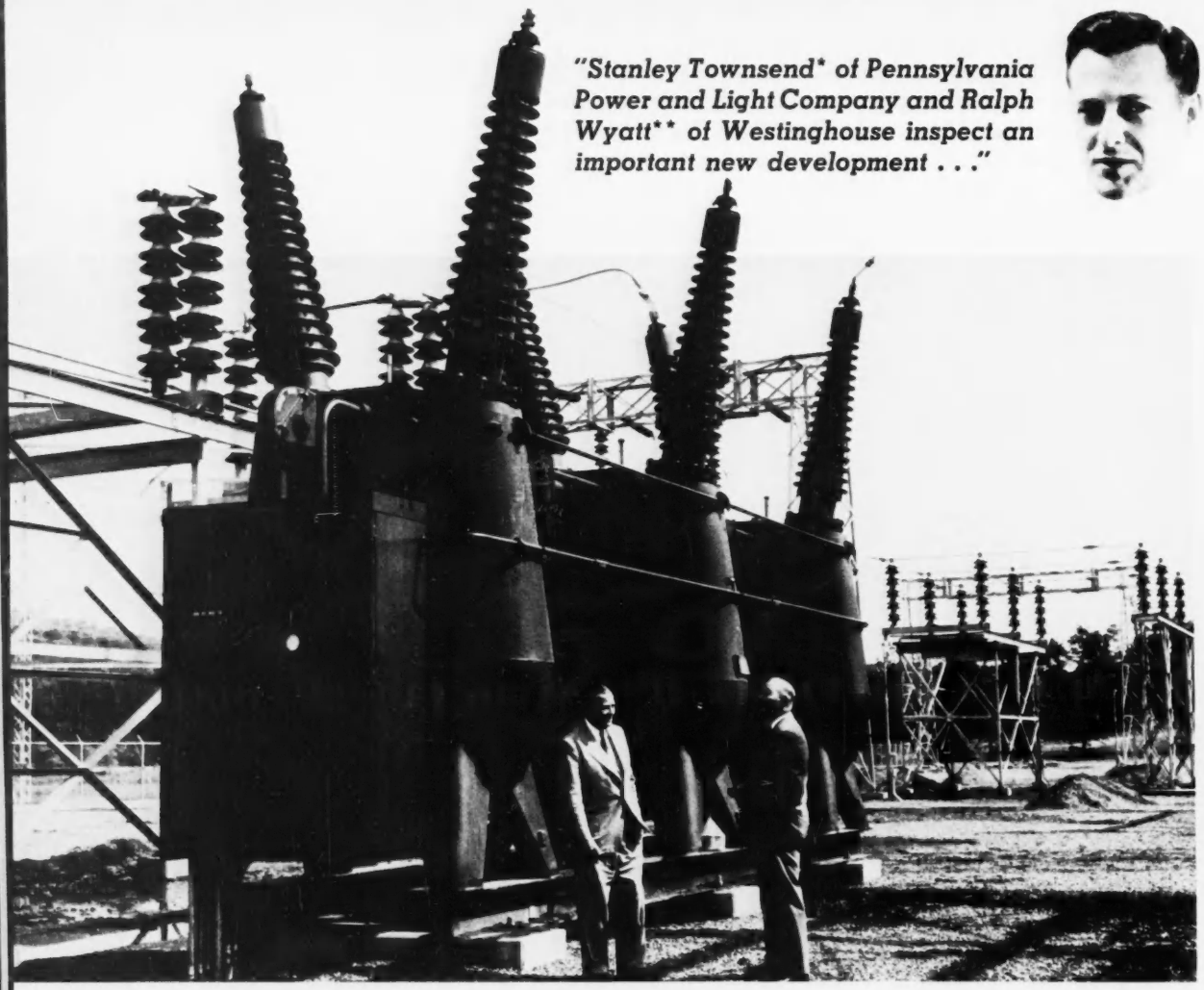


Sudden Pressure Relay installed on tank side near top cover and wired into the conduit-type tank bracing rib.



Internal view of relay showing its isolation from tank gas space, equalizer, pressure-sensitive device, seal-in relay.

Westinghouse



"Stanley Townsend of Pennsylvania Power and Light Company and Ralph Wyatt** of Westinghouse inspect an important new development . . ."*

Latest type breakers protect PP&L'S modern 230-kv system

Here in the Hosensack Station, Pennsylvania Power and Light Company chose the most modern breakers available today. Westinghouse Watchcase† Breakers, to protect their advanced 230-kv transmission.

Mr. Townsend liked the Westinghouse Watchcase Breakers because of their demonstrated interrupting ability. The heart of these breakers, the "De-ion®" grid, has been thoroughly tested and verified in the Westinghouse High Power Laboratory as well as by years of successful field service.

Pennsylvania Power and Light Company gained further advantages through the selection of these breakers. The reduced oil content of Westinghouse watchcase design did not require the installation of expensive oil handling facilities, but permitted the use of existing mobile oil handling equipment. Result: substantial savings in construction and maintenance costs. These 230-kv watchcase breakers are steel-skid mounted. The three tanks and operating mechanism are factory assembled on heavy I beams and shipped as a unit. As a result, they reduced installation time and expense.

The AA-10 operating mechanism provides 20 cycle reclosing, and being mechanically trip free permits three cycle interruption either on an initial opening or following a reclosing. Write now for more information on the application of these modern breakers to your transmission systems. J-60833

†Trade-Mark

*Mr. Townsend is Electrical Engineer, Pennsylvania Power and Light Co.
**Mr. Wyatt is Manager of the Westinghouse Allentown Office.

YOU CAN BE **SURE**...IF IT'S

"Since relays stand guard over your transmission system, here is Bill Glassburn, Westinghouse Relay Engineer, with some good news on low-cost relay protection."

Now you can get lower cost relay protection for distribution feeders

High-speed clearing of phase faults on sub-transmission lines and distribution feeders at lower cost is now made possible by the development of Westinghouse HRZ relays. These relays help you guard against long outages and damage to your transmission system. They provide instantaneous fault protection for 80 to 90% of the line section, together with backup protection which can be more effectively coordinated with inverse overcurrent relays on adjacent line sections.

The type HRZ relay contains, all in one case, an instantaneous (HZ) element, an overcurrent (CO) element, a directional element, and auxiliary contactor switches. Operation indicators are also included to show whether tripping was due to the operation of the instantaneous impedance element or the time-delay overcurrent element.

Lower cost HRZ relays are designed for use on lines not protected by power line carrier relaying or similar more expensive equipment. They give utilities high-speed protection on installations which otherwise would be without it.

The HRZ relay is typical of the many engineering developments that have made Westinghouse a leader in the relay field.

Write to Westinghouse for more information on how HRZ relaying can be applied to your system.

J-40450

Westinghouse

"Jim Owens discusses a line of disconnecting switches with dependability designed into every detail . . ."*

See why these unusual switches give you unmatched system protection

These Westinghouse disconnects are designed with a combination of features not available today in any other switch. They give you unmatched protection. Here are the specific reasons why:

The troublesome problem of shunts on the live side has been eliminated on the RL, as on previous Type V switches, by ingeniously designed, high-pressure line contacts. These contacts are never broken. They're completely enclosed to protect against corrosive atmospheres and adverse weather conditions. The maintenance cost is low.

These switches are lubricated for life, with Oilite bushings on the live side and stainless steel bearings under the rotating insulators. The switches are mounted on formed-steel bases which house the bearing, so that there is no shaft extension. These bases provide large-area mounting surfaces. The contacts are multiple-line type with heavy silver.

Where the use of a two-insulator, single-horizontal-break disconnecting switch is indicated, we invite you to compare the RL with any similar device.

Write now for more information. J-60834

*Supervising Engineer, Disconnecting Switch Section

YOU CAN BE **SURE**...IF IT'S

"Newman Henry, Manager of Instrument Transformer Engineering, points out an important link in transformer protection . . ."

Accuracy hermetically sealed-in for long-term protection

The high accuracy of instrument transformers has a direct bearing on the reliable operation of protective devices on your transmission system. Therefore, it is *vital* that accuracy be built in—and sustained.

The high accuracy of Westinghouse instrument transformers is *hermetically sealed-in* by these processes:

1. All tank seams arc welded and air pressure tested
2. HV bushing flanges are rolled on to porcelain
3. HV flanges welded to tank
4. LV bushings solder sealed

The security of all joints of the complete vacuum-filled assembly is then proved by an oil-pressure test.

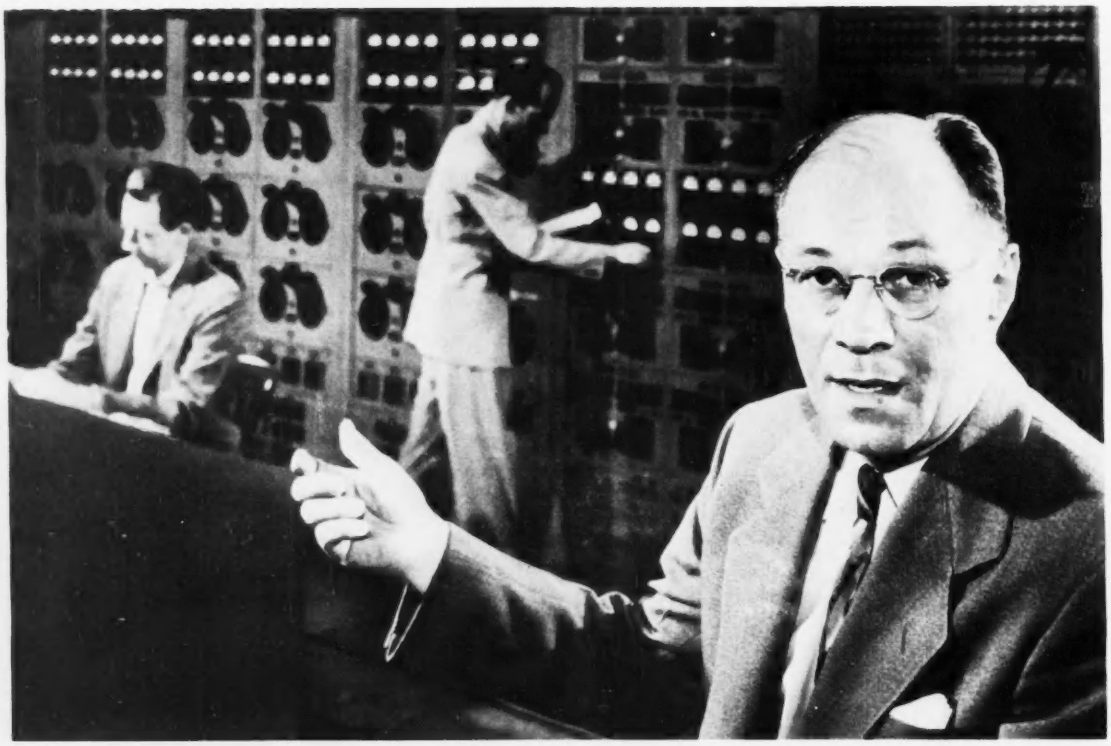
There are many other outstanding features of Westinghouse instrument transformers such as Hipersil® Cores, oxygen-free copper, controlled insulation power factor that make them the best transformers for your transmission system.

Your nearby Westinghouse representative is ready and willing to discuss more fully their application to your specific problem. Why not get in touch with him?

J-70697

Westinghouse

"Shown here at the network calculator in East Pittsburgh is L. L. Fountain of Switchgear Engineering. He discusses another unit . . ."*



World's biggest network calculator will solve mysteries of system protection

The world's biggest network calculator with 580 circuits is now being built at our East Pittsburgh works for seven major Middle Atlantic power companies. It will be installed at the Franklin Institute in Philadelphia and will go to work in 1954. The new unit will be the 30th calculator in the United States, of which Westinghouse has built the majority.

One big job of the new calculator will be to solve transmission protection problems for the seven utilities owning it. It is in effect a power system in miniature. A single-line diagram of the system under study is mounted on a translucent board. Small lights underneath indicate the circuits being metered. Sensitive instruments with automatic scale selectors show just what would happen under actual system operating conditions.

**Manager, Technical Section*

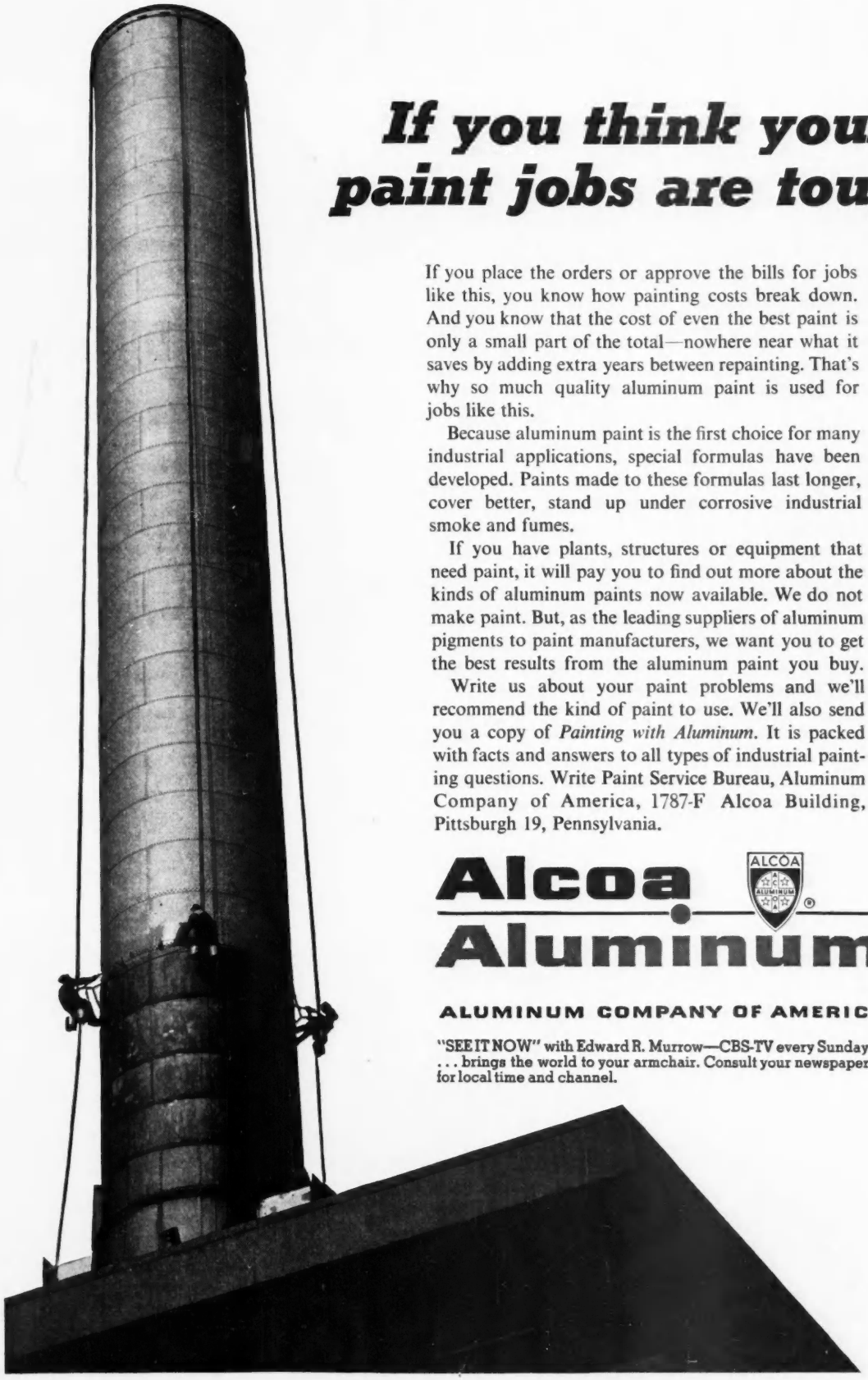
The a-c network calculator has made two great contributions to the industry. First, it is a tool which helps the utility engineer plan and design his system with assurance. Second, it has brought electric utility problems closer to the electrical manufacturer. Result: a better understanding and knowledge of the apparatus characteristics which are needed to provide well-designed and coordinated system performance.

★ ★ ★ ★ ★ ★

Write now for more information on calculator installations or on the products described on preceding pages. Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. CP-5(1008)

YOU CAN BE **SURE**...IF IT'S

Westinghouse



If you think your paint jobs are tough

If you place the orders or approve the bills for jobs like this, you know how painting costs break down. And you know that the cost of even the best paint is only a small part of the total—nowhere near what it saves by adding extra years between repainting. That's why so much quality aluminum paint is used for jobs like this.

Because aluminum paint is the first choice for many industrial applications, special formulas have been developed. Paints made to these formulas last longer, cover better, stand up under corrosive industrial smoke and fumes.

If you have plants, structures or equipment that need paint, it will pay you to find out more about the kinds of aluminum paints now available. We do not make paint. But, as the leading suppliers of aluminum pigments to paint manufacturers, we want you to get the best results from the aluminum paint you buy.

Write us about your paint problems and we'll recommend the kind of paint to use. We'll also send you a copy of *Painting with Aluminum*. It is packed with facts and answers to all types of industrial painting questions. Write Paint Service Bureau, Aluminum Company of America, 1787-F Alcoa Building, Pittsburgh 19, Pennsylvania.

Alcoa Aluminum

ALUMINUM COMPANY OF AMERICA

"SEE IT NOW" with Edward R. Murrow—CBS-TV every Sunday . . . brings the world to your armchair. Consult your newspaper for local time and channel.

Easy to install...

That's why TRANSITE DUCTS save time, labor and money

THESE "ON THE JOB" photographs show why savings begin right at the start of the installation when you use Transite* Ducts.

The light weight of Transite Conduit and Korduct permits hauling a substantial footage of duct per truck. Handling is fast, too, because the asbestos-cement composition of Transite Ducts makes them strong and tough. The longer length of each duct . . . 10 feet . . . reduces the number of joints in the completed line. And joints are quickly made with the Transite Tapered Coupling that is engineered to stay tight in service.

For the full story of how Transite Ducts can reduce your cableway costs, write Johns-Manville, Box 60, New York 16, New York.

4 OTHER REASONS WHY TRANSITE DUCTS DO A BETTER JOB AT LESS COST:

1. Corrosion-Resistant. Transite, being made of inorganic asbestos and cement, resists corrosion and is immune to electrolysis.

2. Permanently Smooth Bore. Transite makes long cable pulls easy. Danger of damage to cables is also minimized.

3. Incombustible. Transite will not burn nor contribute to formation of smoke, gases, or fumes . . . confines burn-outs and protects adjacent cables permanently.

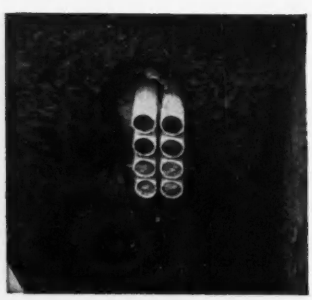
4. Higher Thermal Conductivity. Cables run cooler in Transite, reducing I^2R losses, increasing current capacity and prolonging insulation life.

Easy to Handle: Working in a deep trench, this man finds that the light weight of Transite Ducts helps him work without undue strain.

*Reg. U. S. Pat. Off.

Speeds Installation: Transite Ducts are joined so rapidly that the assembly man can often follow right behind the trencher . . . as shown in this installation.

Speeds Distribution: The light weight of Transite Conduit enables the contractor to haul a large number of ducts per truck and speed distribution on job site.



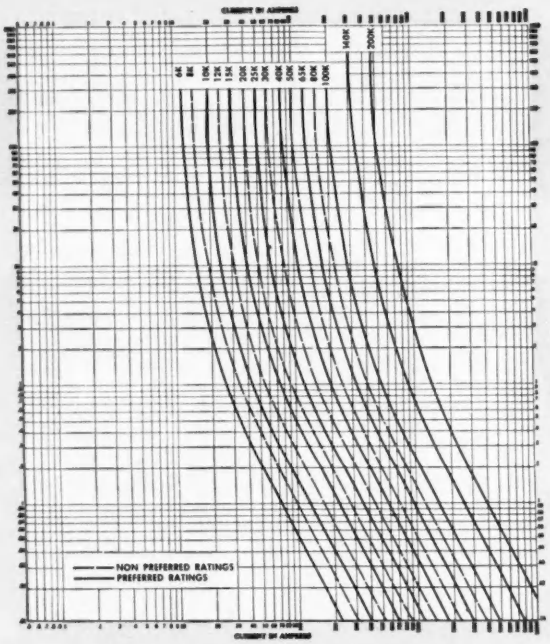
Cuts Manhole Costs: Concrete will be poured directly around these Transite Ducts to form the manhole wall, a time and material saving made possible by Transite's strength.

JOHNS-MANVILLE JM PRODUCTS

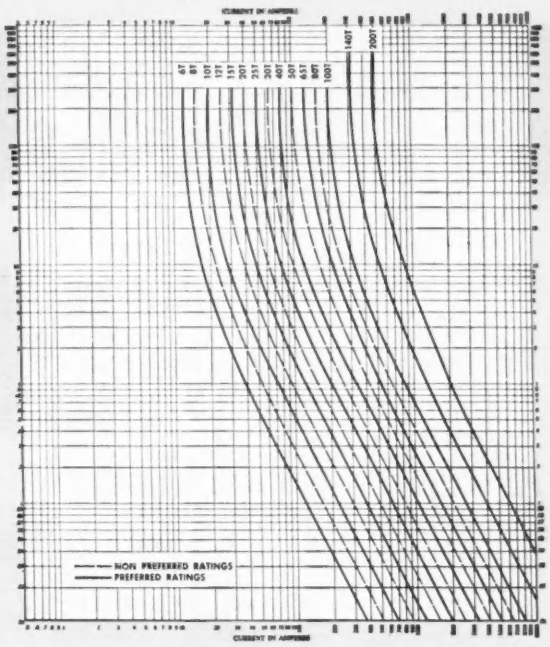
Johns-Manville TRANSITE DUCTS

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement



"K" (fast) Links—minimum melting curves. Speed ratios vary from 6 to 8.1.



"T" (slow) Links—minimum melting curves. Speed ratios vary from 10 to 13.

Large size copies of these curves available from L-M on request

L-M Makes Available Complete Line Of New EEI-NEMA–Standard Fuse Links

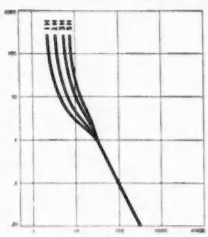
By **R. D. Cleaves**
Manager
Protective and Switching
Equipment Sales
Line Material Company

A joint project between users, represented by EEI, and manufacturers, represented by NEMA, has recently resulted in the establishment of definite time-current characteristics for fuse links. These have now been adopted as standard by the industry, in sizes covering all major operating requirements.

As a major fuse link manufacturer, Line Material Company has now made available a complete line of links meeting the new standards. L-M's new EEI-NEMA Fuse Links offer you these benefits:

1. **Industry-standard mechanical and electrical interchangeability, with assurance of uniform degrees of coordination between adjacent link sizes.**
2. **Two speeds—"K", fast, and "T", slow —with time-current characteristics to meet all major operating requirements.**
3. **Better coordination with reclosers covering a wider range of fault currents.**
4. **Simplified purchasing, stocking, and application.**
5. **Positive performance, precise electrical characteristics, and guaranteed quality.**

New L-M High Surge Links for sizes below 6 amperes



L-M High Surge Links —minimum melting curves

Today transformers are frequently worked up to their maximum thermal capacity. In protecting from overload, the protecting fuse link should remove the transformer from service whenever this capacity is exceeded. But it is important that the fuse link does not blow from surges and momentary overloads, causing needless outages and service trips.

Links large enough to stand these surges will not give adequate overload protection. Therefore L-M has provided a line of High Surge Links in 1, 2, 3, and 5 ampere sizes, which will stand the momentary inrush currents, and yet provide adequate protection.

These links have characteristics similar to 1, 2, 3, and 5 ampere N-rated links on the low current end, and 10 ampere N links on the high current end. These L-M High Surge Links allow good coordination with either the 10-"K" or 8-"T" EEI-NEMA links; and they supplement the EEI-NEMA-standard line.

Get Full Information

Ask the L-M Field Engineer for details and copy of new Bulletin FC5A. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Rating clearly marked on button. One-piece forged button and shank. Horn fibre protective tube. Die-cast tin fusible section.

LINE MATERIAL

fuse cutouts and fuse links

It's Time to Roll Up Your Sleeve—Give Blood Now

WIDE ACCEPTANCE

of these L-M HEAVY

5 kv

50 amperes, 8000 amperes interrupting capacity

100 amperes, 14,000 amperes, interrupting capacity

200 amperes, 20,000 amperes interrupting capacity

Two years ahead of other manufacturers, L-M announced a line of heavy duty "PHD" fuse cutouts with interrupting capacities up to 20,000 amperes. Today, their wide acceptance all over the country proves the need for these cutouts designed especially for heavy duty service.

Here is the first complete line of cutouts for high capacity distribution feeders—designed and built especially for heavy duty service.

Reasons for This Wide Acceptance

Here are some of the reasons why these Line Material "PHD" (porcelain heavy duty) cutouts have been so widely accepted:

1. L-M was first in the industry with a complete line of heavy duty box cutouts having realistic and usable interrupting capacities:
2. Users have confidence in interrupting capacity ratings assigned.
3. Elaborate and detailed testing was conducted over a two-year period prior to manufacture.
4. L-M has paid special attention to the largest and smallest of design details, such as cementing, contact alignment, door and cartridge positioning—all of which govern successful cutout operation.
5. "PHD" cutouts are safe to use. They interrupt high fault currents successfully and eliminate danger of exploding porcelain.
6. These cutouts are designed to clear high fault currents as well as low fault currents, thereby insuring service continuity.

"PHD" is a Line Material Company trademark

PROVES THE VALUE

DUTY CUTOUTS

50 amperes,
4000 amperes,
interrupting capacity

100 amperes,
8000 amperes
interrupting capacity

Customers Like HD Cutouts

From three utility companies who are using "PHD" cutouts come these comments:

"We're ordering nothing smaller than 100 ampere boxes and no cutout with less than 10,000 amperes interrupting capacity."

"We've standardized on the 5000/8000 ampere rating for overall use—in close to substations, the 'PHD' 100 ampere cutout with 10,000/14,000 amperes rupturing capacity will be used exclusively."

"The 'PHD' 200 ampere cutout with up to 20,000 amperes interrupting capacity certainly helped us out of a jam. We use it to protect feeders tapped off high capacity buses."

Here's Complete "PHD" Line

5 kv Rating	Interrupting Capacity rms amperes	
	2.5 kv*	5 kv**
50 amps.	8,000	5,000
100 amps.	14,000	10,000
200 amps.	20,000	15,000
7.5 kv	Interrupting Capacity	
50 amps.	4,000 amperes	
100 amps.	8,000 amperes	

*2.5 kv or line-to-neutral 4160 or 4330 volts Gr. Y. **5 kv or line-to-neutral 8330 volts Gr. Y.

Get Complete Information

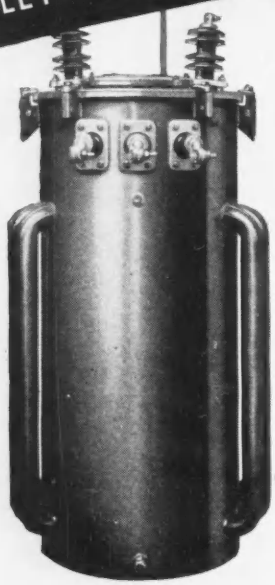
If you aren't already using "PHD" cutouts, ask the L-M Field Engineer for a Bulletin; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL

LM®

fuse cutouts and fuse links

LET'S LOOK AT THE FACTS



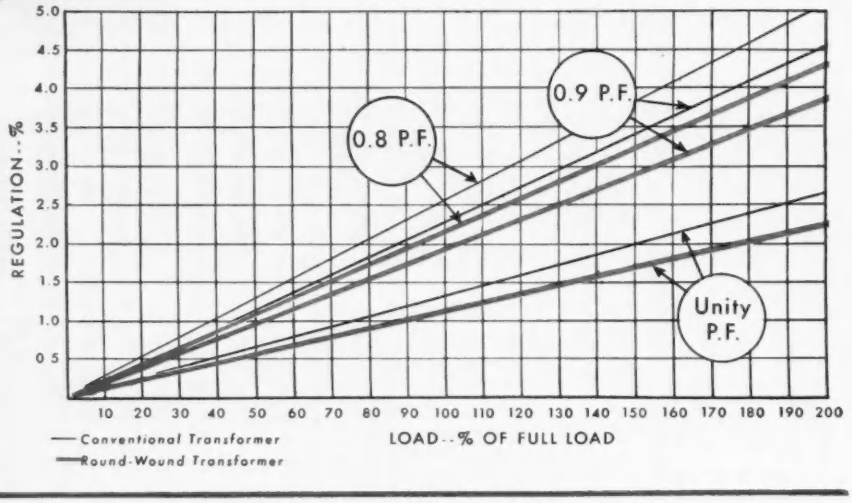


FIGURE 1—Regulation of a standard 50 kva 2400—120/240 volt Round-Wound transformer compared with that of a conventional transformer, showing the effect of load and power factor on regulation.

How L-M Round-Wound Design Improves Transformer Regulation

A brief discussion of the design factors affecting regulation, and the differences in the design of Round-Wound transformers that result in better regulation at all power factors.

By **JAMES G. EVERHART**
Chief Engineer,
Transformer Division,
Line Material Company

Voltage regulation, always an important factor for consideration, has in recent years received even more attention. Higher average secondary voltage at full load means brighter lights, less lamp flicker, and improved operation of the growing number of appliances. It is particularly important in the operation of television receivers, where low voltage produces far greater effect than is generally known by the public.

Higher voltage produces greater revenue to the utility company and, in these days of extremely close margins or actual operating losses, utility companies cannot afford to neglect any source of potential revenue.

State power commissions also have become factors in maintaining regulation. And with the higher average loading of transformers prevalent today, voltage regulation becomes a somewhat more pressing problem.

Use of Capacitors Helpful

Much can be gained from the use of capacitors to improve voltage conditions. But capacitors alone cannot be expected to solve the entire problem.

Neither can adequate primary voltage, ample transformer rating, or shorter secondaries of ample size. The transformer *itself* must be designed to provide good regulation.

Methods of Improving Regulation

Poor regulation in a transformer is largely the result of high impedance due to high reactance, and high copper loss. Often large mean-turn diameter is the cause of high copper loss and poor regulation. In general, most design improvements that will reduce copper loss will also contribute to improved regulation. The problem in transformer design is to achieve the desirable results without the sacrifice of other desirable performance characteristics.

Regulation also must be uniformly good over all power factors. Figure 1 indicates the effect of load on regulation, it being evident that the poorest regulation is obtained with combinations of high loads and low power factors.

Regulation with Round-Wound Design

A Round-Wound transformer basically consists of a wound core, with long round coils wound directly onto the annealed core. With the exclusive L-M method, the core is not cut or unwound in any way. This is not necessary since the coils are wound directly onto the core in an L-M designed winding machine. The construction is shown diagrammatically in Figure 2.

The design achieves a number of advantages—better cooling throughout the coils, with better overload capacity; lower exciting current; lower copper loss.

"Round-Wound" is a Line Material Co. trademark.

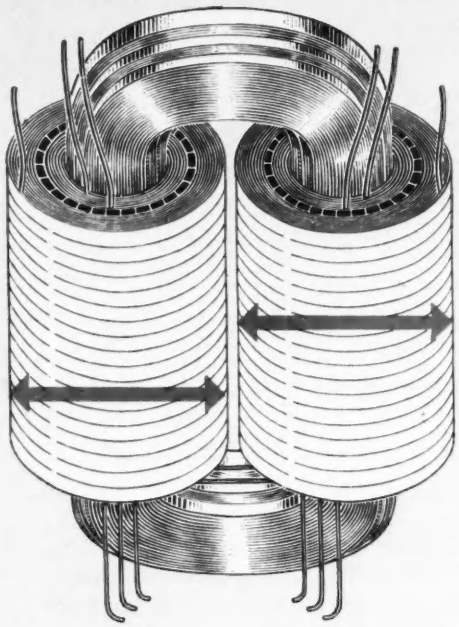


FIGURE 2—Round-Wound design. Long round coils are wound directly onto a wound core. Coils have low mean-turn diameter, a principal factor in the good regulation of Round-Wound transformers.

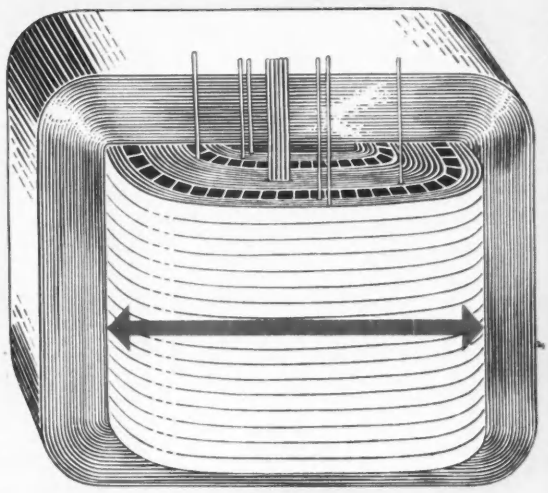


FIGURE 3—Shell type transformers generally have a much larger mean-turn diameter contributing to higher impedance, higher reactance, higher copper loss, which in turn results in poorer regulation.

The desirable smaller mean-turn diameter of the L-M coils is evident, by comparison of Figures 2 and 3 and examination of Figure 4. A higher efficiency core-coil arrangement also permits fewer winding turns. The combination of smaller turn diameter and fewer turns results in lower reactance and impedance, and in the desirable regulation indicated by Figure 1.

Thus the economy-minded power company can well take advantage of this Round-Wound design to secure, at one time, the savings offered by better regulation, lower losses, lower exciting current, and higher overload capacity.

Desirable Characteristics of L-M Round-Wound Transformers

Better Regulation: low resistance and reactance, providing low copper loss and better regulation, with more revenue to the utility and better service to customers.

High Short-Time Overload Capacity: long round coils and ample passages for oil circulation provide exceptionally good cooling with relatively low copper and hot-spot temperatures, permitting higher short-time overloads and higher load factors.

High Uniform Impulse Level: round coils are wound evenly, without hammering to shape; have longer creepage distance; ample insulation between layers and windings.

High Short-Circuit Strength: round coils have fundamentally superior strength characteristics, contributing greatly to the long life of Round-Wound transformers.

Low Exciting Current: because the wound core is not cut or disturbed, air gaps are not created in assembly, and exciting current is appreciably lower in this design.

Better Loss Ratios: the Round-Wound design makes possible an improved ratio of losses with lower total losses without sacrificing low exciting current.

For More Information

Ask the L-M Field Engineer for bulletin on L-M Round-Wound design, or write Mr. Everhart at Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

Round-Wound transformers are filled with ORTO®, L-M's oxidation-resistant transformer oil, inhibited for longer life.

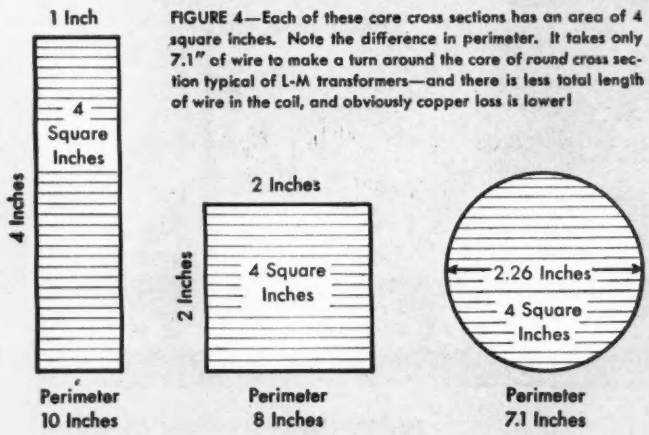


FIGURE 4—Each of these core cross sections has an area of 4 square inches. Note the difference in perimeter. It takes only 7.1" of wire to make a turn around the core of *round* cross section typical of L-M transformers—and there is less total length of wire in the coil, and obviously copper loss is lower!

LINE MATERIAL
Transformers

Complete Coordinated Equipment for Distribution Today

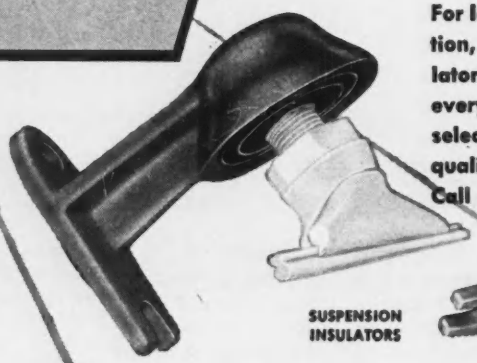
KEYSTONE INSULATORS for INDUSTRY

CONTACT RAIL (TYPE BMS)

"SERVICE-ENGINEERED"

FOR UNFAILING PROTECTION ON THE TOUGHEST JOBS!

For longer, stronger life and peak protection, there's a Keystone Industrial Insulator that's "service-engineered" to meet every need. Let ESM engineers help you select the right mechanical and electrical qualities to solve your insulator problems. Call on them soon.



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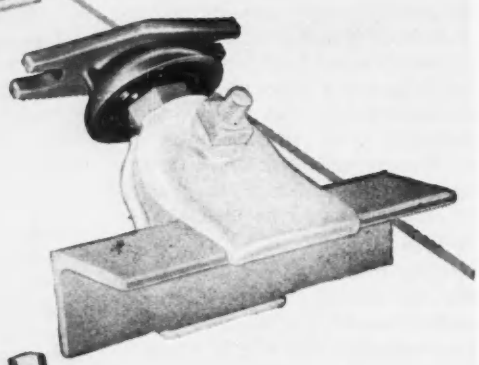
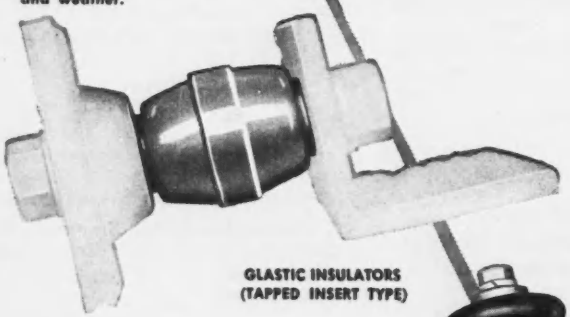
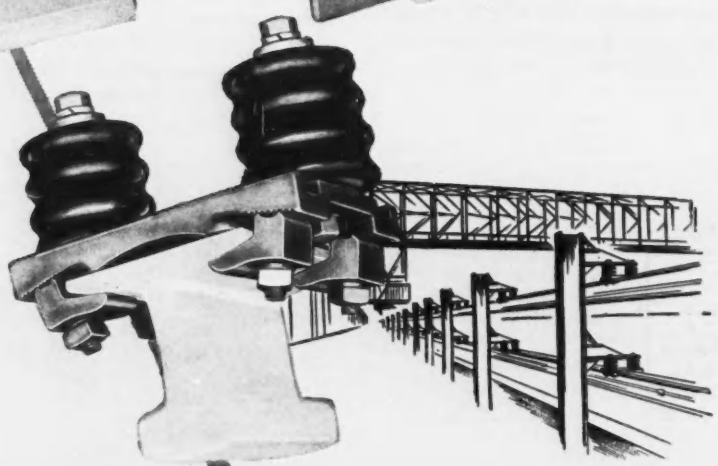
Fibreglass reinforcement and superior compounds provide maximum impact strength with excellent resistance to arc track, chemicals, heat and weather.



SUSPENSION INSULATORS

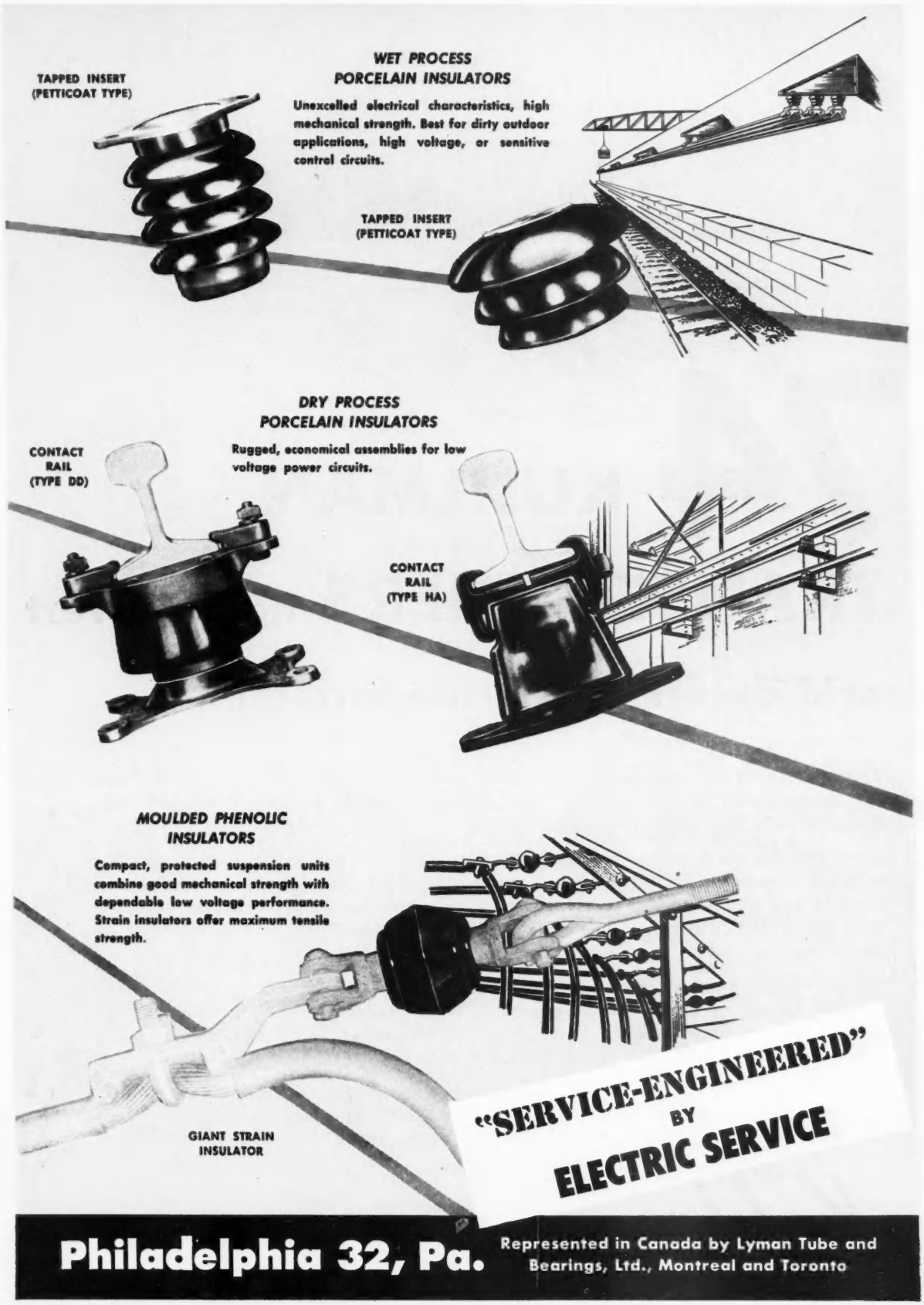


GLASTIC INSULATORS (TAPPED INSERT TYPE)



Basic units shown have great variety of application by use of proper fittings, selected from our Industrial Catalog. Write for illustrated folder.

ELECTRIC SERVICE MANUFACTURING CO.


TAPPED INSERT
(PETTICOAT TYPE)
WET PROCESS
PORCELAIN INSULATORS
Unexcelled electrical characteristics, high mechanical strength. Best for dirty outdoor applications, high voltage, or sensitive control circuits.
TAPPED INSERT
(PETTICOAT TYPE)
DRY PROCESS
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Rugged, economical assemblies for low voltage power circuits.
CONTACT
RAIL
(TYPE DD)
CONTACT
RAIL
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MOULDED PHENOLIC
INSULATORS
Compact, protected suspension units combine good mechanical strength with dependable low voltage performance. Strain insulators offer maximum tensile strength.
GIANT STRAIN
INSULATOR
"SERVICE-ENGINEERED"
BY
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Philadelphia 32, Pa.
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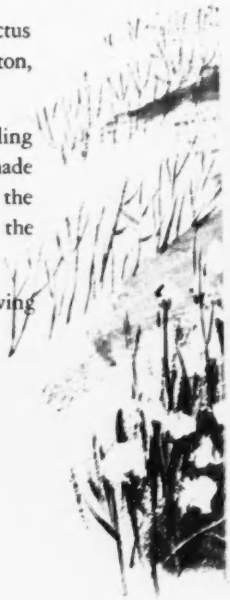
74 KUHLMAN TRANSFORMERS help convert arid desert into fertile farmland

A few years ago, the land surrounding Pecos, Texas, was a vast tract of sandy desert where mesquite, cactus and catclaw were the principal vegetation. Today, that same land produces a bountiful harvest of cotton, cantaloupe, alfalfa, grain sorghum and many other crops.

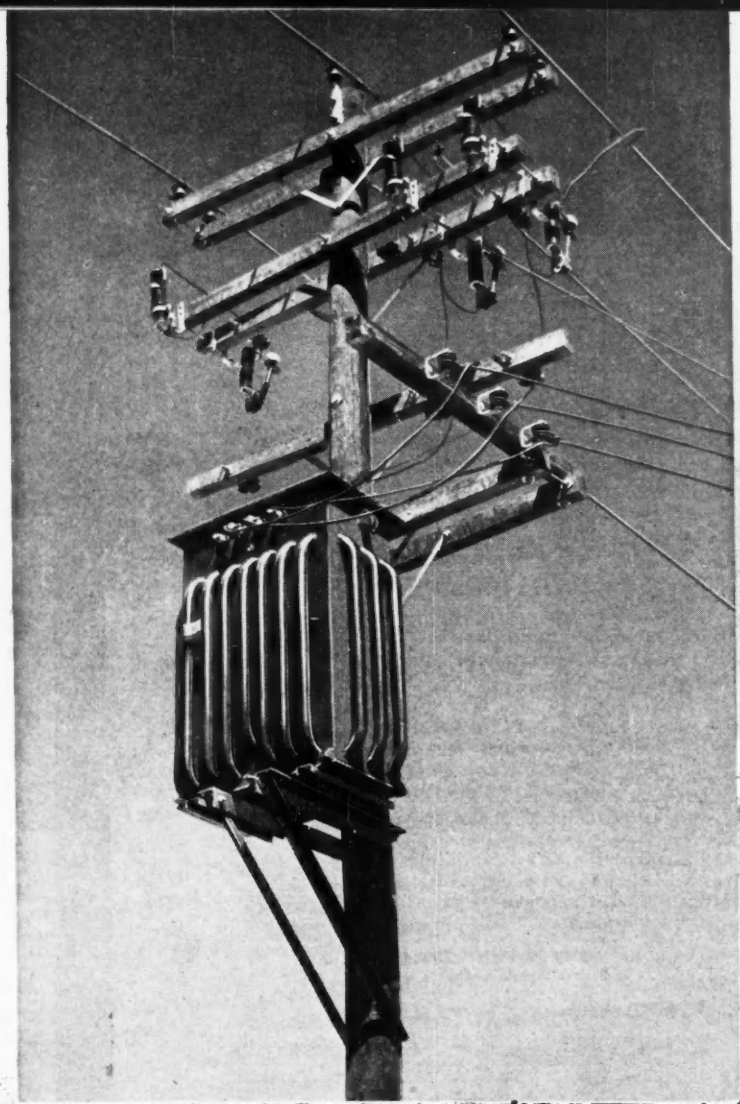
Seventy-four Kuhlman three-phase Transformers helped accomplish this miracle. For electricity, providing the energy to pump water from irrigation wells at the rate of 1000 to 3000 gallons per minute, has made it possible to reclaim thousands of acres of the parched range land. And the power company serving the Pecos area installed 74 Kuhlman Transformers totaling approximately 10,000 KVA to help carry the electrical load.



Selecting Kuhlman Transformers was a sound decision, because Kuhlman Transformers have been serving agriculture and industry with dependable equipment for more than 60 years. Kuhlman Transformers, including power, distribution, dry type, Saf-T-Kuhl, subway, rural, series and C.S.P., are designed and built to insure long life and safe, efficient performance.

The new modern plant of Kuhlman Electric Company at Crystal Springs, Mississippi is ready to supply the needs of utilities and industries throughout the South. It will pay you to specify Kuhlman for your next transformer installation. Write us today for complete information.

Kuhlman ELECTRIC COMPANY



Pictured at the left is a typical installation. This Kuhlman transformer is a 112½ KVA, 12000 DELTA—240 x 480 DELTA.

138

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI

EXPORT REPRESENTATIVE: *International Standard Electric Corporation,*
15th Floor, 50 Church Street, New York 7, New York. CABLE ADDRESS: Microphone, New York

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You take the guesswork out of truck buying when you buy International trucks. They are proved all three ways to give you the performance you want at the *lowest* cost:

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2. **Proved After They're Built.** Economy, performance, and stamina of Internationals is proved again at the "Desert Whipping Post," 4000-acre Proving Ground in Arizona, under the most difficult operating conditions.
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See them. Compare them. Drive them. Ask your nearest International Dealer or Branch for all the facts.

Select the International That's Right for Your Job from America's Most Complete Truck Line.

168 basic models from ½-ton to 90,000-lb. GVW rating . . . 307 new features . . . 29 engines, with widest practical choice of gasoline, LPG or diesel power, available to give the right power for the job . . . 296 wheelbases . . . Transmissions and axle ratios to meet any requirement . . . Thousands of variations for exact job specialization.

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Rolling shop on the job. New International Model R-120 with special service-utility body—77 and 89-inch lengths. 115 and 127-inch wheelbases. All compartments triple-sealed to keep out dust and moisture.

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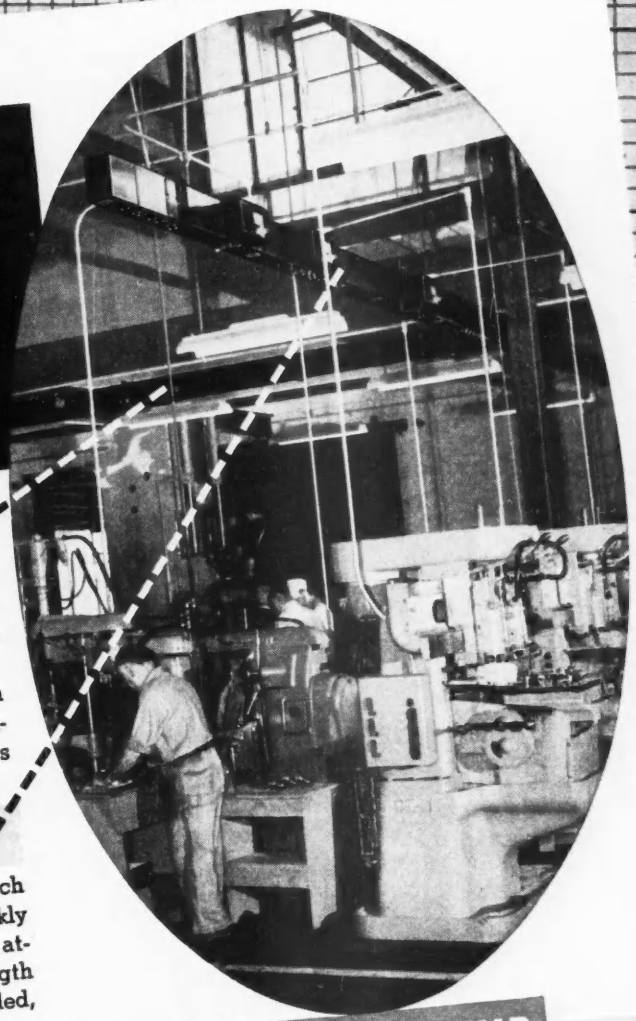
Better roads mean a better America

INTERNATIONAL TRUCKS

"Standard of the Highway"

for time-saving, money-saving

POWER DISTRIBUTION



SQUARE D FEED-IN DUCT

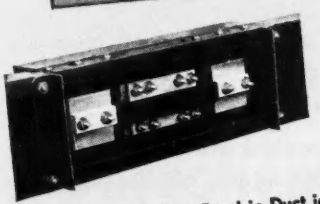
is the most efficient way to transmit large amounts of power. It provides the lowest known voltage drop—only 1.8 volts per 1000 amperes per 100 feet.

Exclusive design requires no ventilation—permits a totally enclosed, compact, dust-excluding enclosure. Rigid construction provides high resistance to heavy electrical stresses.

SQUARE D PLUG-IN DUCT

provides flexible power distribution for branch circuits. Machinery can be rearranged quickly at minimum cost. Plug-in units can be attached at frequent intervals along the length of the duct, providing power where it's needed, when it's needed.

BUSWAY FEATURES PROVE DESIGN LEADERSHIP



NEW JOINT DESIGN. Feed-in Duct joint design saves installation time and reduces maintenance cost. Duct ends are identical—unnecessary to select mating ends before positioning or hanging duct sections. Outward-facing, pre-installed bolts permit rapid assembly and easy maintenance.

ROUND BUS BARS for Plug-in Duct provide greater mechanical strength and resistance to short-circuit stresses. Circuit breaker or fusible type plug-in units are easily installed at 2-foot intervals along both sides of the duct. Plug-in stabs grip the round bus bars with exceptionally high pressure.

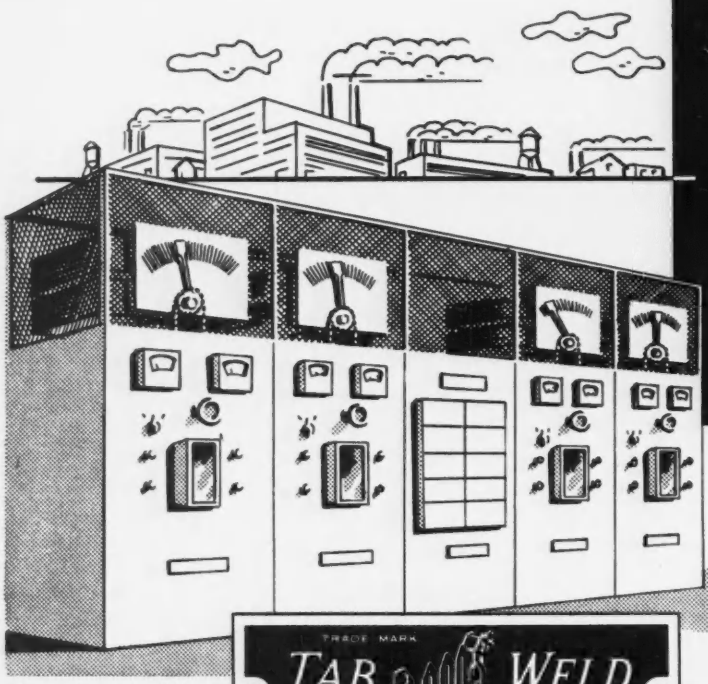
FLEXIBLE CONNECTORS of laminated copper join bus bars between sections—permit proper alignment, insure tight joints and provide for expansion and contraction at Plug-in duct joints. All bolt heads face outward for greater accessibility.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

1903 · 50 YEARS OF DESIGN LEADERSHIP · 1953

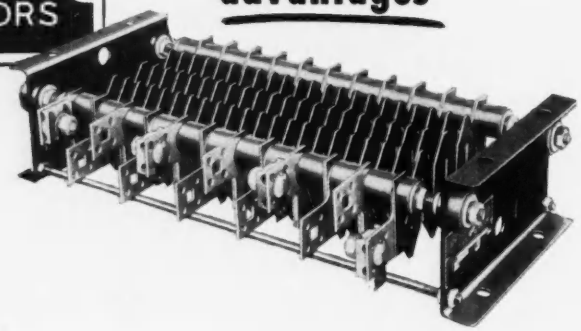
for SMOKE Precipitators



Control board for PRECIPITATORS in eastern power plant. EC&M TAB-WELD Resistors are mounted at the rear and connected to the contacts of the tap-changing switches on the top deck of the panelboard.

TRADE MARK
TAB WELD
PLATE RESISTORS

EC&M TAB-WELD Plate Resistors have many advantages



1. **Stabilized OHMIC Value**
2. **Practically no change in resistance between cold and working temperatures**
3. **Made of corrosion-resisting materials for LONG-LIFE**

In EC&M TAB-WELD Resistors, the grids are assembled on insulated rods—clamped by nuts into intimate contact—and then welded to maintain contact and insure a continuous current-path.

Tests show that clamping-nut pressure slackens under alternate heating and cooling, but since the off-set tab-ends of adjacent grids are *welded* in the TAB-WELD design (an exclusive EC&M feature), the OHMIC value is stabilized, independent of end-clamping-nut pressure. Tap-plates are likewise welded in place.

Also, don't overlook the corrosion-resisting properties of the plate material used in EC&M TAB-WELD Resistors. It has negligible change in resistance-value between cold and normal working temperatures. It will pay you to investigate EC&M TAB-WELD Plate Resistors.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET ★ CLEVELAND 4, OHIO

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In heavily industrialized areas, utilities can cut their installation and maintenance costs with light, tough DURASHEATH*. This flexible, easily handled cable may be run buried in the earth, in ducts or overhead (or in any combination) without needless, time-consuming jointing. Its light weight and flexibility make duct pulling fast even in zero weather. Aerial assemblies go faster. Linemen like to work with it. And you need stock only one cable type.

* * *

As one of several types of ANACONDA power cables, DURASHEATH is available in all sizes, single or multiconductor, copper or aluminum, from 600 to 15,000 volts. It is thoroughly dependable for industrial plants, railroads, series or multiple street lighting, traffic control, and airport† lighting, residential primaries and secondaries, as well as for such uses as Type USE cable for underground service entrance. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.*

*Reg. U. S. Pat. Off. 53313

ANACONDA®

Primary and secondary distribution cables • building, machine tool, control and communication wire • portable cords and cables • bus-drop cables • apparatus cables • copper, aluminum, copperweld conductors • wire and cable accessories.

†when ordered to CAA Specifications L-824

For faster, safer clearance that lasts for years

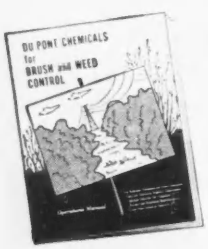
Kill Brush with DuPont Ammate®

Many users report one spray with Du Pont "Ammate" kills brush so thoroughly that repeat sprays are not needed for years.

In most cases, when the original spray job is done well, brush is kept under control with nothing more than occasional spot sprays starting five or more years later. This assures lower cost brush control with less work for your maintenance crews or custom sprayers.

Here's why "Ammate" works so well.

- **Kills roots of brush as well as tops, yet allows low-growing natural cover to come back.**
- **Control lasts for years, saves labor of hand cutting or annual spraying.**
- **Reducing to a minimum the hazard of damage by spray drift.**
- **Not hazardous to operators, livestock or wildlife. Nonflammable.**



Free illustrated booklet describes how to control brush in rights of way with Du Pont "Ammate." For your copy, write Du Pont, Grasselli Chemicals Dept., Wilmington, Del.

On all chemicals always follow directions for application. Where warning or caution statements on use of the product are given, read them carefully.

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

FILE SECTION 930

Single Phase

60 Cycles

POLE TYPE

TYPE PRS STEP VOLTAGE REGULATORS

BUSHINGS — of tough homogenious porcelain are compress-gasket-mounted in the tank cover to insure shock resistance and prevent entrance of moisture. They conform to AIEE Standards for bushing tests.

COVER CLAMPS — closely spaced to assure uniform sealing pressure for tank cover.

LIFTING LUGS — welded to main tank wall are properly spaced to facilitate handling.

TANK—heavy gauge, copper bearing steel, seam welded, provides rugged all-tight enclosure for entire regulator. Three coats of paint, baked-on, provide a scuff-proof, weather-resistant finish.

SUPPORT LUGS — welded to tank wall are standard NEMA size.

POSITION INDICATOR — magnetic type, moisture-proof construction. Mounted at an angle to facilitate observation of regulator tap position from base of pole.

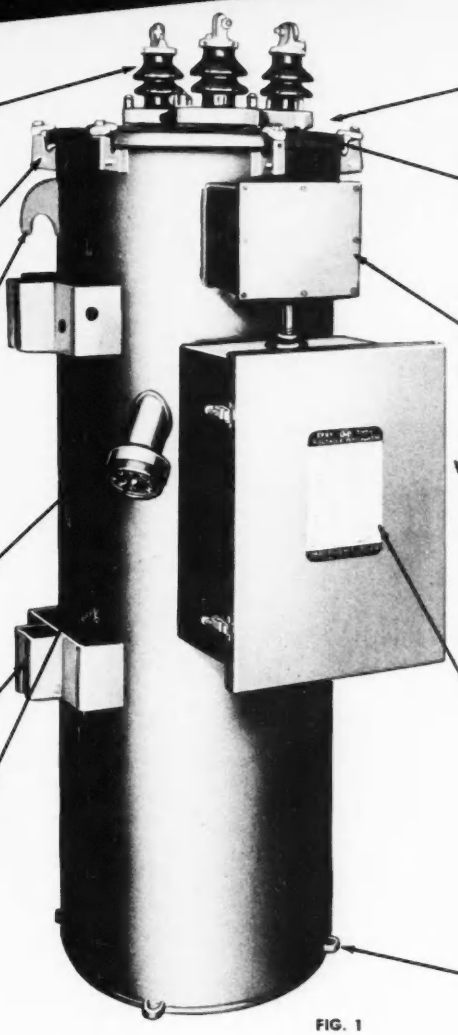


FIG. 1

COVER — heavy gauge, copper bearing steel provides rigid mounting surface for cover bushings.

COVER SEAL—neoprene gasket provides weather-proof, air-tight seal between tank and cover.

OUTLET BOX — weather-proof construction encloses terminals of all internal control connections. Standard outlet at bottom of box permits accessibility for conduit connection from control cabinet when mounted at base of pole.

CONTROL CABINET — contains all control equipment. Hinged front panel is gasketed and is secured by two toggle clamps affording both weather-proofing and accessibility. Cabinet is bolted to tank wall and may be removed for mounting at the base of the pole.

NAMEPLATE — of stainless steel shows schematically all regulator connections and lists all regulator ratings.

ANCHOR LUGS—welded into the tank base for platform mounting.

HAND-HOLE — in tank cover permits access to regulator for inspection and maintenance. (Not shown)

GROUND LUG — provides means of grounding tank. (Not shown)

RELIEF VENT — relieves tank pressure above 3 p.s.i.g. (Not shown)

OIL DRAIN and SAMPLING SERVICE — permits draining or sampling of regulator oil. (Not shown)

MOLONEY ELECTRIC COMPANY

SAINT LOUIS 20, MISSOURI

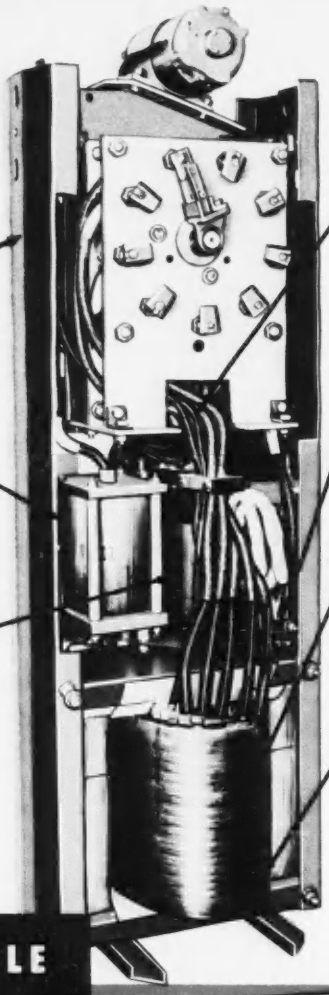
LTC-905P

INTERNAL CONSTRUCTION

SUPPORTING FRAME—heavy gauge structural steel provides rigid support for entire regulator.

CURRENT TRANSFORMER—provides current for Line Drop Compensator.

SWITCHING REACTOR—acts as a potential divider when tap selector switch is bridging two tap terminals and as a current limiter during switching. It is designed to draw a minimum of K·va from the line when acting as a potential divider without causing a noticeable flicker in lighting during switching.



CONDUCTORS—of well-insulated, heavy gauge stranded copper cable provide ample current carrying connections between regulator parts.

CORE CLAMPS—rigidly anchor the core-and-coil assembly to the main frame.

MAIN WINDINGS—include exciting winding and tapped series winding of the regulator, together with the potential source for operation of control equipment.

WOUND CORE—of oriented cold rolled silicon steel incorporates the famous Moloney HiperCore wound core design providing a lighter weight, more efficient, and compact core-and-coil assembly.

FIG. 2

OPERATING PRINCIPLE

Moloney Type PRS regulators provide 10% plus and minus voltage regulation in 32 equal steps of 5/8% each. These regulators are completely self-contained and fully automatic in operation. They are available in all standard voltage and current ratings for use in a wide range of applications. These regulators are especially effective on rural feeders and lightly loaded urban lines where closer voltage regulation improves consumer relationships and at the same time increases revenue and permits maximum loading of existing lines.

The heart of the regulator is the switching mechanism consisting of a tap selector switch and a reversing switch. The selector switch consists of two moving contacts and two sets of stationary contacts arranged in circles and mounted on separate insulating panels to permit reduction in overall size and increase in insulation clearances.

The position of the tap selector switch determines the magnitude of the regulating voltage. The reversing switch position determines whether the regulating voltage bucks or boosts the line voltage.

Operation of the switching mechanism is monitored by a sensitive, accurate control system capable of distinguishing between poor regulation and sporadic variations, so as to provide proper voltage regulation and at the same time eliminate needless operations.

Adjacent diagrams schematically show the sequence of operation for two complete steps of the tap changer. Colored lines indicate the path of load current.

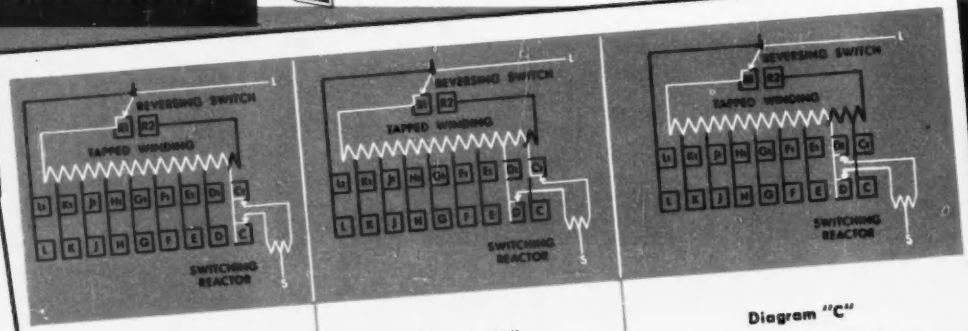


Diagram "A"

This diagram shows the full buck position. The moving contacts are on stationary contacts "C" and "C1", and reversing switch is in the bucking position "R1". In this position, full 10% buck is provided.

Diagram "B"

If the line voltage decreases sufficiently, the automatic control equipment initiates a tap change in the "Raise" direction. The moving contact of one-half of the tap selector switch advances to contact "D". The other moving contact remains on "C1". The switching reactor acts as a potential divider to provide an intermediate position for 9 3/8% buck.

Diagram "C"

If the line voltage again decreases sufficiently, the automatic control equipment initiates another tap change in the "Raise" direction. The other moving contact advances to "D1", resulting in 8 3/4% buck in voltage. When the moving contacts are on "L" and "L1", the regulator is in the neutral position. As the mechanism moves from neutral to the first boost position, the reversing switch changes to position "R2". This occurs just prior to the operation of the moving contact of the tap selector switch.

SWITCH MECHANISM

1 **MOVING CONTACT** — of arc resistant copper-tungsten alloy makes contact on both sides of the stationary blade. Contact fingers are drawn together by spring compression providing optimum pressure for maximum contact life. A spring-loaded accelerator provides quick-make, as well as quick-break, action to all switching, thereby minimizing arcing.

2 **CONTACT CLAMP** — of rugged cast copper, provides sturdy support for Moving Contact.

3 **STATIONARY CONTACT BLADE** — of copper-chrome alloy, is tipped with copper tungsten to minimize arc erosion.

4 **MOUNTING PANEL** — of heavy bakelite provides insulated surface for mounting the switch contacts.

5 **DRIVE MOTOR** — of gear reduction type, is capacitor start, capacitor run. The reduction unit is completely enclosed and oil filled.

6 **ACCELERATING SPRINGS** — of spring steel, store energy until they overcome accelerator loading. They supply power for the quick-break, and quick-make action of the selector switch.

7 **ACCELERATING CAM AND LOADER** — loading device which bears against cam stops until accelerating spring tension overcomes resistance and releases cam. Energized accelerating springs transfer snap action to switch.

8 **LIMIT SWITCHES** — open the motor circuit to prevent over-travel at the two extreme positions of the tap selector range.

9 **PILOT SWITCHES** — assure completion of each tap change after it is initiated.

10 **POSITION INDICATOR DRIVE GEAR** — is driven, by the main drive shaft through an intermittent pinion, to drive the Position Indicator and Limit Switch Cams. Mechanical stops are also attached to this gear to provide mechanical over-travel protection.

11 **GENEVA GEARS** — two gears are provided. Each is connected to a separate moving contact through concentric shafts. The driving pinion is arranged to operate the two moving contacts alternately when making a tap change.

12 **REVERSING SWITCH CAM** — operates Reversing Switch by engaging a pin on the Geneva Gear.

13 **REVERSING SWITCH** — changes polarity of the tapped winding so it can either buck or boost the output voltage. This switch is mechanically timed to operate when current flow is zero.

14 **GENEVA PINION** — has engaging pins which alternately operate the Geneva Gears.

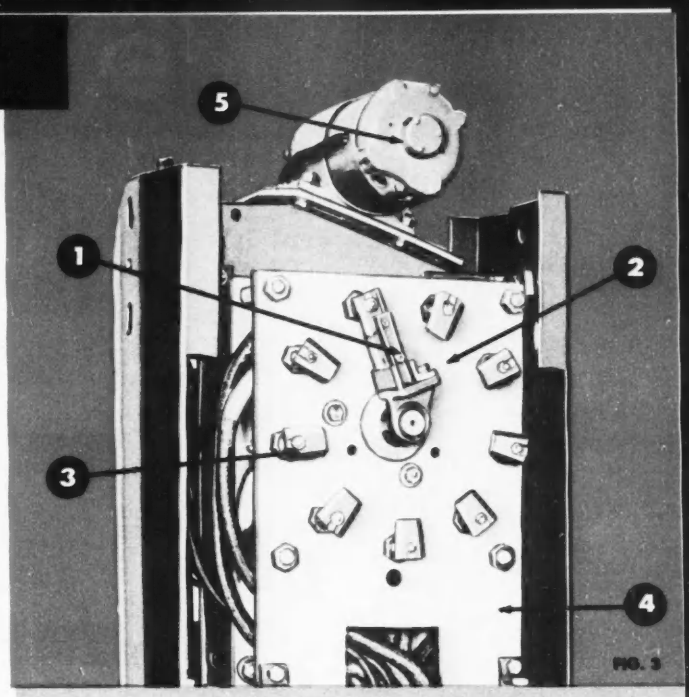


FIG. 3

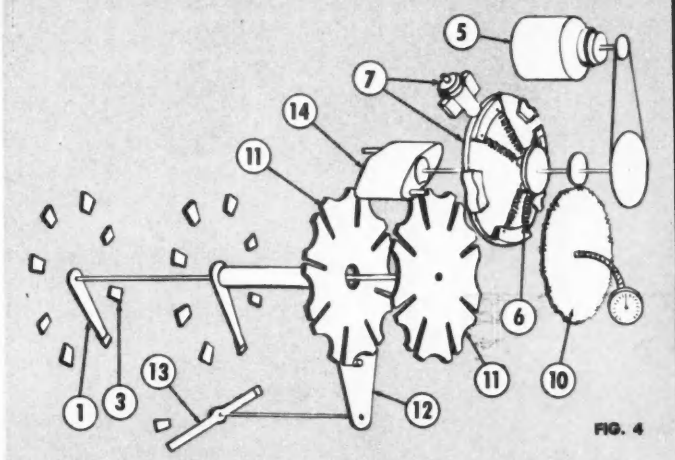


FIG. 4

DRIVE MECHANISM

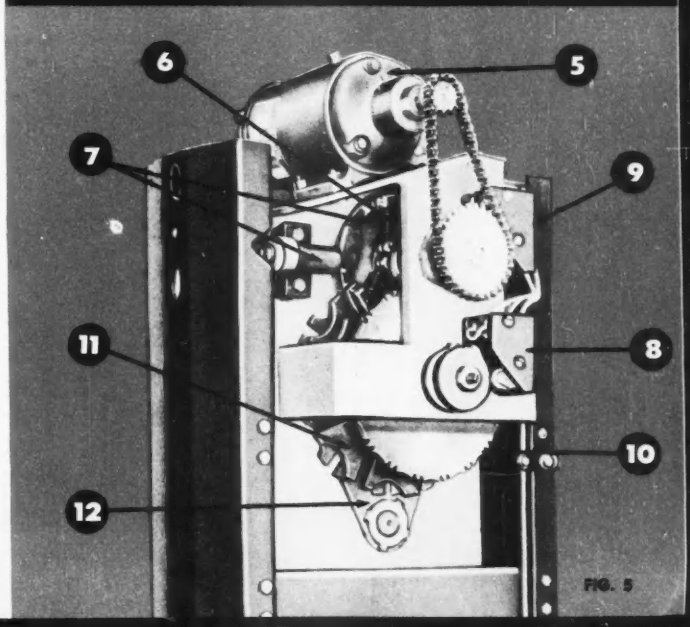


FIG. 5

CONTROL EQUIPMENT

CONTROL CIRCUIT BREAKER — of the thermal overload type provides overload protection for control equipment and a circuit disconnect for safe control panel maintenance.

ADJUSTMENT KNOB — for Resistance Component of Line Drop Compensator affords full range of adjustment.

ADJUSTMENT KNOBS — for Reactive Component of Line Drop Compensator affords full range of adjustment. Voltage drop across Resistance and Reactive Components simulates voltage drop of feeder circuit as a function of the load, allowing the regulator to maintain constant voltage at a distant point.

VOLTAGE ADJUSTMENT RHEOSTAT — permits calibration of the Voltage Regulating Relay without introducing an external power source.

CONTROL SWITCH — provides manual raise or lower as well as selection of automatic operation of Regulator.

VOLTAGE LEVEL RHEOSTAT — permits adjustment of the operating level of the regulator output voltage.

LOCKING SCREWS — rigidly hold control equipment panel in place, yet permit removal of panel for servicing.

VOLTAGE TEST TERMINALS — permit reading regulated voltage.

TIME DELAY RELAYS — provide a time delay to the initiation of any automatic operation of the regulator thus preventing unnecessary operations resulting from short time variations in voltage.

METER SHELF — folds away into panel cover when not in use, provides a working surface during inspection and maintenance.

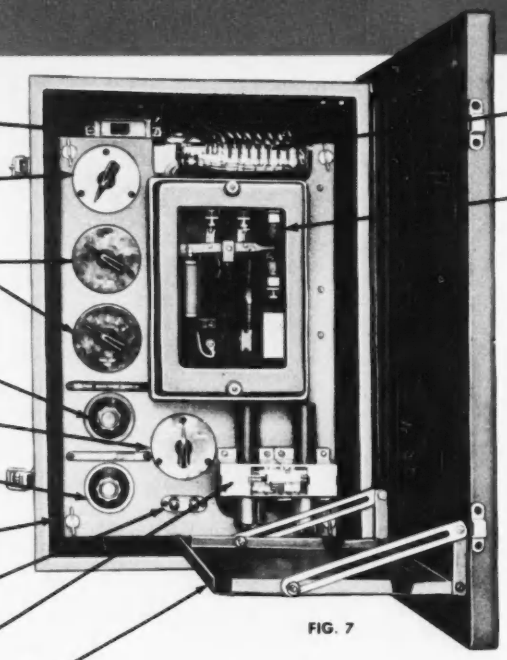


FIG. 7

TERMINAL BOARD — easily accessible, permits front wiring of all incoming control wire, yet is easily removed for access to rear panel control equipment wiring.

VOLTAGE REGULATING RELAY — is sensitive to all variations of output voltage. Initiates an impulse for a voltage increase or decrease when output voltage varies from normal.

ISOLATING TRANSFORMERS — of wound core construction, transfer the Resistance and Reactive Components of the Line Drop Compensator to the Voltage Regulating Relay.

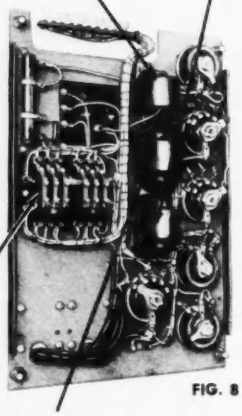


FIG. 8

REACTOR — for the Line Drop Compensator, of wound core construction, provides the Reactive Component of load line drop to the Automatic Control Circuit.

MOTOR STARTER — is mechanically interlocked to prevent simultaneous energizing of both motor coils. Auxiliary contacts provide additional circuits for operation of the automatic control equipment.

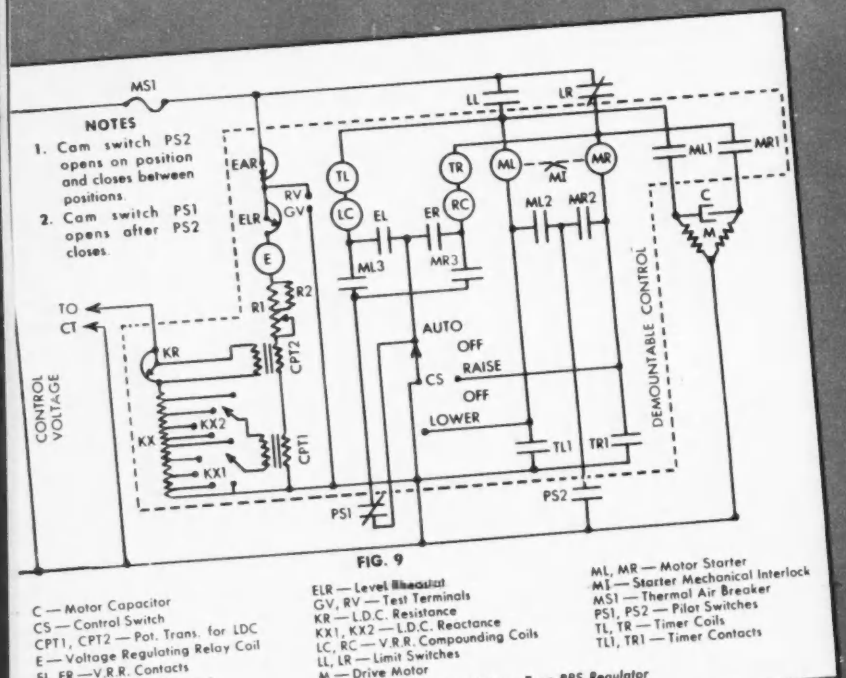


FIG. 9

C — Motor Capacitor
CS — Control Switch
CPT1, CPT2 — Pot. Trans. for LDC
E — Voltage Regulating Relay Coil
EL, ER — V.R.R. Contacts
EAR — Adjustment Rheostat
ELR — Level Rheostat
GV, RV — Test Terminals
KR — L.D.C. Resistance
KX1, KX2 — L.D.C. Reactance
LC, RC — V.R.R. Compounding Coils
LL, LR — Limit Switches
M — Drive Motor
ML, MR — Motor Starter
MI — Starter Mechanical Interlock
MS1 — Thermal Air Breaker
PS1, PS2 — Pilot Switches
TL, TR — Timer Coils
TL1, TR1 — Timer Contacts

A typical control schematic diagram for the Moloney Type PRS Regulator

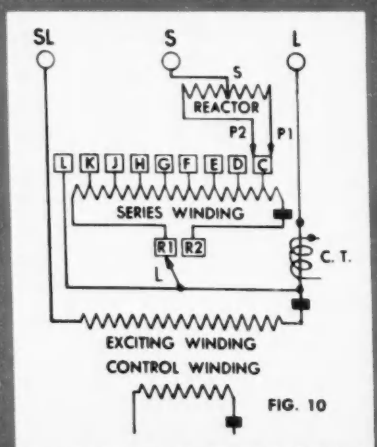


FIG. 10

A typical internal connection diagram of the Moloney Type PRS Regulator

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

The Philosophy of the 4,500-Psi Philo Project

(As described by Philip Sporn, President, American Gas & Electric Service Corp)

The major outlines of the history-making Philo 4,500-psi project, treated at some length in this issue of ELECTRICAL WORLD, are simple enough. It is a 120,000-kw tandem-compound, 3,600-rpm steam turbine generating unit with its complement of steam generator, pumps, heaters, and condensers operating at a pressure of 4,500-psi at the turbine throttle. Initial temperature is 1,150F, reheat is at 1,050F with a second reheat at 1,000F. Thermal performance expected is 8,500 Btu per kwhr. True, 4,500 psi is above the critical pressure of steam; 1,150F is a new high in superheat; and also double reheat has never been tried heretofore in any commercial installation. These are, however, technical details. Other and more fundamental aspects of this project are more significant.

The Philo project reflects the outstandingly dynamic character of the electric power industry. Here, in the very important field of energy generation, new frontiers are being pushed forward. Here, new avenues of approach to improvement in capital costs, in efficiency, and in operating costs, are being opened. And, in keeping with the tradition that has characterized the growth and development of the industry, the results of this pioneering achievement will be made available to the rest of the industry.

The fact that in this industry this dynamic spirit is being maintained will have an important bearing on maintaining the indispensable good opinion of the American public, of all regulatory and governmental bodies, and of investors. We know that government steps in when a vacuum is created as a result of lack of performance by private industry—by failure to meet a challenge. Here, however, is another demonstration of challenge again being met, as it has been met with some minor exceptions by the private American power industry throughout its almost 75 years of existence. And the investors in the industry are bound to be affected and influenced by this renewed demonstration of the resourcefulness and dynamism of the industry; of its ability to cope with unfavorable factors like materially higher costs of equipment, labor, and supplies—particularly fuel.

It is obvious that developments like Philo also have an important bearing on the morale of the people within the industry and those outside whom the industry is trying to attract. No people of ability, imagination, and enterprise can be expected to be attracted to any venture that is static or declining. And an industry that cannot attract its share of the young and the able cannot, over a long period of time, do anything but decline.

There has been some indication of an effort to interpret this challenging development in the economics of power generation as an answer on the part of some members of the power industry to the challenge of atomic power. This, obviously, is not only wholly without foundation but, as a matter of fact, does not make very much sense. The electric power industry long ago indicated its awareness of the potentialities and its determination to explore and develop atomic energy whenever or just as soon as it can be done with benefit to its consumers. But while waiting and helping to bring this about, it would be an act of folly to neglect opportunities for further development of technologies that have done so much to bring the industry to its present flourishing state. *The electric power industry, far from challenging any particular method of generating energy, demonstrates by this Philo project its readiness to adopt and bring forward every new development that can advance its technical and economic well being.*

As long as that spirit can be maintained the confidence of the public, the regulating bodies, and the government can be maintained—and the confidence of the investors can also be maintained. This means that the industry will be able to continue to grow and meet its fundamental responsibilities of providing an adequate, reliable, supply of electric service at the lowest cost consistent with proper compensation to those who dedicate their lives to the service, and proper compensation to those who dedicate their property.

Committee on Aluminum Is Needed

Aluminum just is not getting the concerted technical analysis and development that should parallel its rapid adoption in the field of electric power. This is not to say that the producers and fabricators of aluminum for electrical conductor use have been lax in supplying information about its properties. They have not been, and there is ample information of a technical nature.

Unfortunately the available information has not been translated into and correlated with the very practical factors that are encountered when aluminum starts to barge into a field that has always been pre-empted by copper. In fact one surmises that aluminum is being allowed to find its "place in the sun" and the user is expected to uncover and override the technical obstacles to the transition.

It is all right to acknowledge that the switch entails a metal of definitely different mechanical, electrical, and chemical properties. But it is not all right to let the user carry all the burden of substitution and adaptation. Heroic efforts are being made to solve the connector problem, and even more heroic efforts will have to resolve the apparatus terminal problem. Take as example the growing use of aluminum service entrance cable. When it reaches a meter terminal block designed for copper wire, it will not fit—it's too big. Even if it does fit, the same screw-driver torque on the terminal clamping screw will not be equally tight after several cycles of heating of the aluminum.

There are dozens of comparable deterrents, and it is incumbent on the aluminum people to set up a forum where these problems can be laid down and the desired solutions indicated and reconciled. There was a Copper Wire Engineering Association, and there is just as much excuse today for an Aluminum Wire Engineering Association of users as well as manufacturers.

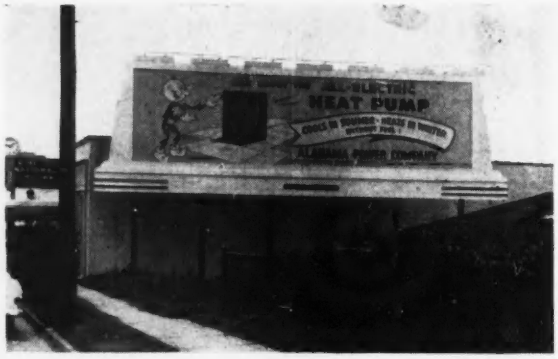
Sell—and Sell—and Sell

In almost no other line of human activity does the paradox that the whole is greater than the sum of its parts have greater force than in selling. What can be done by the organized, coordinated effort of many is always much more than can be accomplished by the same many working separately.

A case in point is the promotion of the gift appeal of electric housewares. This was organized in 1948 by the concerned section of Nema. Compared with that year, total appliance sales took a considerable dive in 1949, but the housewares group took a deeper one. Total sales climbed back nobly in 1950, and housewares rose with them, the promotion then really getting rolling. The real proof of effectiveness of the housewares promotion is seen in the 1951 figures when total appliance sales dropped over 8%, but sales of the housewares group rose about 2%. In 1952 the proportionate increases in total and housewares sales were about even.

Examination of the sales figures from 1949 on indicates that the buying of electrical housewares is less affected by conditions external to the appliance industry than is the purchase of the larger items. This can be taken as the effect of consistent plugging of a selling idea.

And the idea is growing, not only in terms of industry participation—500 dealers in 1948, 50,000 expected in 1953—but in other ways. Publishers of consumer and



trade magazines in increasing numbers are finding that by helping to sell electric housewares they are doing a good job of selling advertising space to the makers of those wares. This year, eight magazines are assisting the promotion by distributing sales helps to selected dealer lists and by playing up the values of electric housewares in articles directed towards the homemaker.

Here, in this promotional activity is evidence of how selling begets selling, how it spreads beyond the field of its origin, how its results accumulate, how it adds up to more than the sum of its parts. This activity illuminates the imperative of our times which is to —sell—and sell—and sell.

Probably it's the first. Let's say it is. First what? First time the heat pump finds itself advertised on a billboard.

Alabama Power Co put it up. It is an expression of the company's estimate that a heat pump saturation of only 10% would double the present kilowatt-hours used by its residential customers. "The heat pump", thinks Alabama Power, "offers greater potentialities for increased comfort and convenience for our customers and for increased residential sales and revenue for our company than any other single piece of equipment that has been placed on the market to date". So the heat pump goes on the billboard.

Prolixity in Coal Clauses

"Thanks. Could we just have it in ohms?"

This is the reaction of "Punch," the British comic weekly (April 8, 1953), to a customers' coal clause of the Southern Electricity Board in Britain. Here it is:

"The unit price (0.6d) is subject to an increase or decrease at the rate of decimal nought nought nought eight of a penny (.0008d) for each penny (a half-penny or any greater part of a penny being treated as a penny), by which the average cost of fuel per ton for the three months ended one month before the month in which the meter is read, multiplied by eleven thousand and divided by the average gross thermal value of the fuel during the same period, expressed in British Thermal Units per pound of fuel as fired, either rises above or falls below thirty-eight shillings as the case may be."

We'd like to have it in ohms on this side of the Atlantic, too, Mr Punch. Although we can say we're making progress here. Some utilities in this country actually use only two fairly long sentences, instead of one terrifically long one, to state the coal clauses in their rate schedules.

THE ELECTRICAL WEEK

The Issue's News Highlights—Federal court upholds contracts under which Missouri co-ops lease REA-financed power facilities to SPA . . . Revision of Atomic Energy Act is not likely to be acted on until next year.

AIEE honors Kinnard and Armstrong at summer meeting . . . Four reports on Hells Canyon development are turned over to FPC by Interior.

Frying Pan-Arkansas project in Colorado has GOP backing. House committee okays bill permitting 5 New York utilities to develop more power at Niagara Falls.

Power conferences are being held by representatives of REA co-ops in Missouri, Arkansas-Missouri Power Co, Missouri Utilities Co, and Southwestern Power Administration to work out an agreement for integration of all power facilities in the southeastern part of the state. Next meeting is scheduled for June 30.

Off the New England Wire—Compact among Massachusetts, Connecticut, New Hampshire, and Vermont, creating the Connecticut River Valley Flood Control Commission, has been approved by Congress and the President. It includes provision for reimbursement by downstream states benefiting from flood control to areas losing taxes on reservoir lands . . . Vermont PSC approves merger of Central Vermont Public Service and Public Electric Light . . . Burlington, Vt., may borrow the money required to complete its new 27,000-kw steam plant on a short-term loan. City Attorney R. W. Larrow says that increasing interest rates in the market may make it desirable temporarily to defer issuing the $2.5 million electric revenue bonds authorized by the voters to finish the $6.5 million plant.

"Preliminary discussions have been held with Allis-Chalmers looking toward an exchange of stock, a merger, a consolidation, or the acquisition by Allis of the assets of the Buda Co." Buda's management told the stockholders in a letter sent to them last week.

Interstate Power Co, Del., directors vote to sell subsidiary, Interstate Power Co of Wisconsin, to Wisconsin P&L . . . Dallas P&L will buy facilities in West Dallas from Texas P&L for $2,467,000 on Aug. 20 . . . Washington Water Power sells $10-million first mortgage bonds and $18-million sinking fund debentures privately . . . Missouri P&L asks PSC approval to raise rates by 10%.

TVA's Shawnee No. 2 unit of 135,000 kw went into commercial operation on June 21. Third 135,000-kw unit is tentatively scheduled for operation in September and a fourth unit of similar size in November.

Austrian firm, represented by American Elin Corp, New York, is apparently low bidder for building two banks of three 115/230-kv transformers for BPA. Bid was $831,900. Next low bid was $1,248,630 by English Electric. Three American companies submitted offers, the lowest being $1,574,196. Pacific Oerlikon, Tacoma, was low at $1,209,500 to supply power circuit breakers.

Off the Washington Wire—Depa. materials control agency for electric utilities, will fold June 30 as planned. Two Depa men, however, will remain in the office of the Interior Secretary to wind up affairs. They are Gardner C. George of Niagara Mohawk and George H. English of Kansas City P&L . . . Senate Appropriations Committee recommends spending $227.3 million next fiscal year for Army Corps of Engineers multipurpose projects. This is $23.3 million more than voted by the House. Senate committee recommended that money for the controversial Table Rock project in Missouri be restored to the tune of $3.5 million. Same committee went along with the House in recommending that Reclamation Bureau restrict its construction of transmission lines.

At a Senate committee hearing last week Oklahoma senators asked that a state agency be allowed to build the Markham Ferry project and that the federal government allot $6.5 million for the flood control portion of the structure.

Lewis L. Strauss, New York financier, is chosen by President Eisenhower to be AEC chairman . . . Nomination of Marvin C. Nichols as reclamation commissioner remains stalled at the White House. Meanwhile Bureau of Reclamation is bearing the brunt of personnel cuts being made in the Interior Department.

Federal Power Commission—FPC schedules a hearing for July 22 on Pacific G&E's application for a $419,400 a year rate hike for power sold to Sierra Pacific Power . . . Georgia P&L and municipal system at Thomasville, Ga., reach an interconnection agreement for city to receive power from Georgia Power Co following completion of study by the FPC staff.

Joppa Unit No. 1 of Electric Energy, Inc, scheduled for service June 17, developed noise during starting. Inspection disclosed cracks in inner cage of generator and loss of six 14th stage turbine buckets. No. 4 generator cage was substituted for No. 1 so work could go ahead. Cage for No. 2 unit was modified in field. The 175,000-kw unit No. 1 is now expected to be ready for operation by July 1.

Halsey Stuart & Co loses competitive bidding battle in the sale of $25 million of first mortgage bonds by Consumers Power Co when the Michigan PSC ruled that the utility can choose the method through which it wishes to raise the money. Previous to the ruling, company had made tentative arrangements with Morgan, Stanley & Co to sell the securities in a negotiated deal.

Congratulations—Winnipeg Electric elects D. M. Stephens president and general manager to succeed W. H. Carter . . . Interstate Power advances L. L. Peterson from executive assistant to vice president . . . James H. Patton is appointed vice president and sales manager of Sangamo Electric . . . Dr Adam S. Bennion has completed his duties as vice president of Utah P&L to become a member of the Council of the Twelve, Church of Jesus Christ of Latter-Day Saints, Salt Lake City.

Co-ops Upheld on Use of REA Funds

- **Federal judge rules against ten utilities in holding contracts between Missouri co-ops and 2 federal agencies are legal**
- **Disputed agreements provide for REA loans to co-ops for power facilities which in turn are leased to SPA**
- **Findings of court appear to endorse "wheeling contracts" and broad interpretation of Rural Electrification Act**

Controversial power marketing and farm electrification loan policies of the former Truman Administration won belated judicial approval from a federal district court last week.

Specifically the court upheld the legality of a series of loan, lease-option and power contracts between five Missouri generating and transmission cooperatives and two federal agencies.

Disputed Contracts

Terms of the disputed contracts provided for Rural Electrification Administration loans totalling some $57 million to the co-ops for construction of electrical facilities. In turn, the co-ops leased the facilities, or power output of the facilities, to Southwestern Power Administration.

Conclusion of the opinion—which merely held that the contracts were legal—was less sweeping than the findings on which it was based. These findings appeared to give court endorsement to:

- "Wheeling" contracts under which SPA and other federal power marketing agencies assume full utility responsibility to preference customers served by them.
- Broad interpretation of the Rural Electrification Act which would allow REA to make loans for service to customers already receiving central station power, or to non-rural users.

On every point at issue the opinion written by Federal Judge Charles F. McLaughlin upheld arguments of government lawyers who defended SPA and REA practices during the trial last October (EW, Oct. 20, 1952, p 97). The co-ops were not parties in the suit which had been brought by ten Missouri electric companies.

The companies, headed by Kansas City Power & Light Co, charged that the federal agencies had conspired to build a federal power empire through unauthorized use of federal funds. Such action, said the companies, constitutes unlawful competition which has caused irreparable injury to private electric utilities operating the Southwest area.

Previous court action had ordered a separate trial to determine the legality of the written contracts. Opinion issued last week dealt only with the contracts.

Company attorneys early last week were not prepared to announce their next move. There is the possibility that the decision in the separate trial will be appealed. Certainly the sweeping decision as it stands severely weakens the remaining issues in the companies' case.

Effects of Decision

Immediate effect of the decision is to affirm the contracts under which SPA assumes responsibility for the operating hundreds of miles of transmission line and buying output of the co-op steam plants. Total cost for carrying out these contracts during the next fiscal year has been estimated at more than $3 million.

Because Republican power policy does not envision the use of such contracts, it is doubtful that the decision will have any effect at all in that particular area of power policy. Democrats, in the last years of the Truman Administration, had all but abandoned the negotiation of such arrangements.

Judge McLaughlin found that former Interior Secretary Oscar L. Chapman was acting well within his authority in negotiating contracts by which SPA would lease transmission facilities and buy the output of REA-financed steam plants.

". . . It is clear to the court," wrote McLaughlin, "that the purchase of thermal energy generated at the steam plants of the cooperatives, which purchase is reasonably incidental to the integration of hydro electric power generated at the reservoir projects, is not prohibited by the provisions of the (1944) Flood Control Act but rather is within the scope of its provisions and in accord with its purpose."

Arkansas Decision

This finding appears to overrule a decision by the Arkansas Supreme Court rendered in February. The Arkansas court held, "Congress has in no fewer than three ways expressed its belief that SPA's proper function is to sell hydro power in wholesale quantities rather than to sell at retail by the integration of steam power."

The Arkansas opinion had formed the legal basis for new power delivery contracts now being sought by utilities to replace "wheeling" contracts.

These new contracts, such as proposed by Georgia Power Co and 12 southwestern companies, would permit the private utility to purchase federally produced power and deliver similar amounts of power to preference customers designated by the federal marketing agency. In this way the public body or co-op is a customer of the utility rather than the federal government.

In present wheeling contracts, the preference customer is a direct customer of the government agency which assumes utility responsibility for serving customer demands. To do this, the agency leases use of transmission lines and purchases non-federally produced power.

Funds Limitation

Oddly enough the opinion was dated June 17—the same day the Senate Appropriations Committee voted to restrict funds available to SPA for carrying out the type of contract upheld by the court. The Senate committee had voted only $2 million for the SPA continuing fund—about two-thirds of the amount SPA would need to fulfill the contract obligations during the next fiscal year. The House deleted this fund altogether.

Atom Act Change...

. . . will not be made until next year. Joint Congressional committee begins open hearings

Congress finally has set up a timetable for removing the legal barriers to private development of atomic power. It calls for legislative action next year.

Meanwhile, the Joint Committee on Atomic Energy, after weeks of secret sessions, has started public hearings on the pro's and con's of private ownership of atomic power plants. These sessions, according to Rep W. Sterling Cole, chairman of the joint committee, and Sen Bourke B. Hickenlooper, vice chairman, are aimed at developing "a public understanding of the subject."

The committee already has in hand recommendations from the Atomic Energy Commission for sweeping changes in the Atomic Energy (McMahon) Act of 1946. These proposals would permit private industry to own and operate reactors (furnaces) and to own the fissionable materials to fuel them for the production of electric power. Some members of the joint committee hoped to amend the McMahon Act along these lines this year.

Delaying Factors . . . But two major factors prevented such early action. First, Congressional leaders want an adjournment by Aug. 1. Considerable legislation, including measures assigned a "must" priority by the Eisenhower Administration, still are to be acted upon. Revision of the McMahon Act is bound to touch off extensive debate and, conceivably, could stall other legislation.

Also, proponents of the AEC amendments found a majority of Congressmen, including some members of the joint committee, completely unprepared for any broad changes in the McMahon Act. This was more a lack of information on the present state of atomic power technology, a secret even from most members of Congress, than serious opposition to the proposed amendments.

That's why Cole and Hickenlooper, in an unusual joint statement describing the current hearings, predicted that "in the next session of Congress we will be able to direct our attention to the question of the desirable legislative language" for changing the McMahon Act.

AEC spokesmen are the first witnesses scheduled for the open hearings. They will be followed by representatives of industry, including members of the five industrial teams which have been studying atomic power possibilities.

Demmler Named SEC Chairman

New Securities & Exchange Commission chairman is Ralph H. Demmler who was sworn in as a commission member June 17 for the balance of a term expiring June 5, 1957. In above picture he is shown as he testified before Senate Banking and Currency Committee.

Demmler, a corporation and banking lawyer, succeeds Donald C. Cook as chairman. Cook's resignation which had been pending since February became effective when Demmler took over.

Cook's departure and the recent resignation of R. B. McEntire leave two vacancies still to be filled on the five-man commission.

The new chairman is a native of Pittsburgh and has practiced law there since 1928. For the past ten years he has been associated with the firm of Reed, Smith, Shaw & McClay of which he has been a partner since 1948.

He specialized in corporate and banking law and participated actively in legal matters relating to Gateway Center development in Pittsburgh. Previously he had been a trust officer of Commonwealth Trust Co of Pittsburgh and for a time served as part-time faculty fellow at the University of Pittsburgh Law School, of which he is a graduate.

Demmler received his AB from Allegheny College in Meadville, Pa.

PRESIDENT-ELECT of AIEE, Elgin B. Robertson (left) is congratulated by Donald A. Quarles, outgoing president, at the institute's summer general meeting. In right panel, Quarles presents the 1952 Lamme Medal to I. F. Kinnard (right) engineer for General Electric Co

AIEE Honors Kinnard and Armstrong

Robertson gets president's badge at institute's Atlantic City meeting. Quarles reports on membership growth

Upwards of 2,300 of the nation's scientists and electrical engineers flocked to Atlantic City during the week of June 15-18 to participate in the program of technical sessions, inspection trips and entertainment that comprise the summer general meeting of the American Institute of Electrical Engineers. Fine weather conspired with the best efforts of the sponsoring Philadelphia Section to make this summer session a resounding success.

Leading off the week-long round of over 55 sessions and 230-odd technical papers was the only general session which featured:

1. Presentation of the president's badge to Elgin B. Robertson, Dallas, Tex., who has been elected president of the institute for 1953-54 (EW June 15, p 98). Presentation was made by Donald A. Quarles, 1952-53 president.

2. Awarding of the 1952 Lamme Medal, one of engineering's top awards, to I. F. Kinnard, General Electric Co engineer of West Lynn, Mass.

3. Presentation of certificate of honorary membership in AIEE to Maj Edwin H. Armstrong, professor of electrical engineering at Columbia University, and inventor in radio field.

4. The president's report to the institute, by Donald A. Quarles.

Kinnard Honored . . . Pres Donald A. Quarles presented the Lamme Gold Medal to I. F. Kinnard for his "outstanding contributions in design and development in instrumentation and measurements."

In accepting the medal, Kinnard, who is manager of engineering, meter and instrument department at GE, stressed the importance of accurate measurement in science.

"In much of our work," he said, "we apply known technical information but real progress usually comes from the discovery, by physicists and other scientists, of new scientific facts. These are the truths that 'open the door' for the creative engineer, allowing him to make further practical advances for the benefit of mankind.

"Man's increasing ability to understand nature's secrets and to discover new scientific truths comes largely from his success in making accurate measurements. Likewise, the engineer finds that his problems become easier, and often quite simple, when he can measure and evaluate the facts of any given situation."

Kinnard, who has developed or been instrumental in improving the accuracy of watthour meters, modern long-scale electrical instruments, photographic exposure meters and aircraft gyroscopes, observed that the watthour meter alone requires the accurate measurement of 150 separate quantities, and the total number of individual measurement may reach thousands and take years to complete.

Honorary Membership Awarded . . . Prof Edwin H. Armstrong of Columbia University, discoverer of fundamental radio principles, was presented with a certificate of honorary membership in AIEE, voted to him by the Board of Directors on April 23. He is the sixth living person to receive this honor.

Professor Armstrong is credited with four basic discoveries that have revolutionized radio broadcasting, both

AM and FM. His discoveries are: The regenerative circuit, the superhetrodyne circuit, the superregenerative circuit and frequency modulation.

In accepting honorary membership in AIEE Prof Armstrong stressed the importance of the inventor and the scientific explorer in the modern world, citing Guglielmo Marconi, the inventor of long-distance wireless telegraphy, as an outstanding example of the pioneering inventor and scientist.

AIEE Membership Growing . . . In the eight years since World War II, AIEE membership has grown as much as it did in the preceding 60 years, Pres Quarles reported at the annual meeting of the institute.

Quarles reported that membership is now well over 45,000 and that prospects are for an increase of about 10% a year despite a decrease in the number of electrical engineering graduates, from among whom about half of the institute's new members are enlisted.

From a peak of about 80,000, electrical engineering student enrollment dropped, about a year ago, to just over 20,000 with a moderate increase this last year to around 25,000. In spite of this recession in enrollment the institute gained somewhat more than 4,000 new members in the fiscal year just ended. "Present indications are that membership growth is likely to continue at about 10% a year unless there is some important change in general conditions," he said.

New President Inducted . . . In accepting the badge of office as incoming president of AIEE Elgin B. Robertson, president of the Elgin B. Robertson Co, Dallas, Tex, pledged himself to further the unity of the profession of electrical engineering. In this connection he pledged himself to support any plan that had the support of a majority of the institute.

President Robertson was tendered a testimonial dinner on the evening of the opening day of the summer meeting by the electrical equipment manufacturers whom he represents in Texas and by the Electrical Equipment Representatives Association which he helped organize and which he served as first president.

Detailed report of the technical sessions of the AIEE meeting will appear in the July 13 issue of Electrical World.

FPC Gets Snake River Studies

Interior turns over to commission reports on development proposals of federal government and Idaho Power Co

Two reports favoring federal development of the Hells Canyon reach of the Snake River have been submitted to Federal Power Commission by Interior Department.

Interior also has handed FPC two other reports finding there is sufficient river flow to justify construction of either a high federal dam or multiple dams proposed by Idaho Power Co.

Hearings on the Idaho Power application to develop the Snake River are slated to reopen before FPC July 7. Interior has stepped out as a special pleader for federal hydroelectric development but submission of these reports indicates the department is making sure both sides of the case are presented.

In addition to the formal reports, Interior offered to make other factual information available and also loan engineering personnel to FPC.

Cotton Report . . . John S. Cotton, consulting engineer of San Anselmo, Calif., wrote one of the reports submitted last week. His summary and conclusions: (1) Neither the 5-dam nor the 3-dam scheme proposed by Idaho Power is economically feasible, although the 3-dam plan is more attractive. (2) The federal Hells Canyon plan is economically feasible and most attractive from all points of view. This plan would provide an additional 600,000 kw of low-cost firm power which otherwise would be lost forever. (3) The federal plan represents high design standards.

The Cotton report estimates the cost of firm power from a federal Hells Canyon project at $19.09 per kw year compared with $41.07 for Idaho Power's 3-dam plan and $48.90 for the 5-dam plan.

Cotton, a member of American Society of Civil Engineers, American Institute of Electrical Engineers, and American Society of Mechanical Engineers, is a former FPC regional engineer. He was retained by former

Saguaro Station Is Taking Shape

Work continues on Arizona Public Service Co's Saguaro steam plant at Red Rock, 30 miles northwest of Tucson. At upper left are carpenter shops, change rooms and warehouse. The tall stack in the center will serve both boilers when installed. Pedestals in center right are for two 100,000 kw generators and boilers. Excavations in the foreground are for switch gear. The first 100,000 kw unit is scheduled to go on the line in the spring of 1954.

Interior Secretary Oscar L. Chapman to prepare the report comparing the proposed Snake River development projects.

Hydrologist's Study . . . A second report written by J. R. Riter, chief hydrologist of Reclamation Bureau's project planning branch, also finds in favor of the federal plan. This report originally had been prepared as a part of Interior's testimony in behalf of the federal project.

Riter finds that the cost per kw of salable firm power at load centers would be $23.30 for the high dam as compared to $25.00 for the company 3-dam plan. But an alternative 2-dam plan, says Riter, could bring this cost down to $23.00.

Reports by a Los Angeles firm of consulting engineers and by Lynn Crandall of U. S. Geological Survey both show there is plenty of water in the river to justify either the plan proposed by the federal government or the company plan.

When asked to comment on the Cotton report last week, T. E. Roach, president of Idaho Power Co. made the following statement to an Electrical World reporter: "With the hearing before FPC just two weeks off it would be improper to publicly debate the merits of the Cotton report. We prefer to present the answers to this and other reports favoring federal construction of Hells Canyon by formal testimony under oath before the commission."

Combustion Engineering Signs Pact with Sulzer

Combustion Engineering, Inc, has concluded an agreement with Sulzer Brothers, Ltd, Winterthur, Switzerland.

The American firm can now use Sulzer's patents, developments, and experience in special controls applicable to boilers for above critical pressure range. The latter is of considerable consequence in view of the new and complex control problems presented by steam pressures of 5,000 psi and higher.

Sulzer's long experience with their specialized design used in the generation of high-pressure steam, Combustion officials believe, will materially reduce the necessary time required in this country to develop boilers for operation at pressures above the critical.

GOP Backs Frying Pan Project

Multipurpose development in Colorado, which has Interior's support, would be first western plan put before new Congress

Republicans are staking a part of their public works record on authorization of the relatively non-controversial Frying Pan-Arkansas project in Colorado.

Barring major hitches, the proposed $173-million multipurpose federal project will be the first large-scale western project to be put before the new Congress for authorization. It calls for diverting water from the Frying Pan River through the Continental Divide to the eastern slope and into the headwaters of the Arkansas River. In addition to the diversion, Bureau of Reclamation plans a series of dams and reservoirs on the eastern slope which would be tapped for irrigation, municipal water supplies, and power generation. Power facilities would have a capacity of 104,800 kw.

Support from Interior . . . Strong support for the project comes from Interior Department, which would build the project, and from bi-partisan local interests. At recent Congressional hearings, the only outright opposition came from ranchers whose lands would be flooded.

Eisenhower Administration is believed to be counting on the authorization bill to offset charges that it is anti-public works. These charges arose when the Budget Bureau drastically reduced funds requests for multipurpose projects and set its policy of "no new starts" for the next fiscal year. These charges were again made when Interior withdrew active support of the proposed Hells Canyon project in Idaho.

With hearings concluded, Congressional committees are now preparing reports on the project. It is possible, but not likely, that the bill will be brought to the floor of one or both Houses this year. Better guess is that floor action will come next year.

Utilities Approve . . . Two electric companies in the project area—Public Service Co of Colorado and Southern Colorado Power Co—have expressed general agreement with the authorization. They have offered to "wheel" or deliver power from project plants to consumers. If accepted, this offer would head off construction of some 400 miles of federal transmission lines in connection with the proposed project.

Frying Pan-Arkansas Project Power Plants

Plant	Average Head (Ft)	Installed Capacity (Kw)	Annual Generation (Kwhr)
Elbert	515	8,700	39,000,000
Otero (Granite)	287	19,200	66,800,000
Wapaco	495	16,500	125,900,000
Princeton	278	11,700	68,500,000
Pancho (Johnson)	268	15,000	64,400,000
Salida	405	22,700	102,400,000
Pueblo	120	11,000	33,000,000

Interior officials appeared to give serious consideration to the company offer. Assistant Interior Secretary Fred G. Aandahl told a Senate Interior Committee: "We look with favor on this type of arrangement."

The project proposes to capture and divert 70,000 acre ft of water annually from the western slope of Colorado through a tunnel to the eastern slope where it would be stored in three reservoirs on the Arkansas River. Six power plants with an installed capacity of 104,800 kw would be situated along the Arkansas (see table). It is estimated these would have a gross annual output of 505 million kwhr of which 400 million kwhr would be firm energy.

Cost Breakdown . . . Of the $173 million estimated cost, allotments would be made in the following manner: $75 million to irrigation, $42 million to power, $32 million to municipal water supply, $20 million to flood control, and $3 million to fish and wildlife.

The new Administration proposes at least one major departure from previous administrations in project accounting. It is this: Revenues from sale of power and from sale of water for municipal purposes is to be used to repay the costs of those features within 50 years with 2½% interest. After 50 years, these revenues are to be used to reimburse the government for remaining irrigation costs.

In the past, interest paid on the power costs has been used to help finance the irrigation costs.

Boiler Is Raised at Omaha PPD Plant

Hoist operators govern the speed of ascent of giant boiler drum as it is raised into position at Omaha Public Power District's new North Omaha generating plant. The 72-ton boiler drum is designed for 1,500 psi at a maximum temperature of 1,005 deg. Omaha PPD's new plant will have a capacity of 75,000 kw. Completion is scheduled for spring of 1954.

House Committee Okays Utilities' Niagara Plan

House Public Works Committee has approved the bill which would permit five New York State electric companies to develop an additional 1.1 million kw of power at Niagara Falls.

The 14-to-7 vote came on a motion to report favorably the Dondero-Miller bill to the House. At the same time, the committee voted to shelve bills which would authorize federal and New York State construction of the project.

Democratic Rep Robert F. Jones of Alabama, who voted against the company bill, said a minority report would be submitted to the House.

House Speaker Joseph W. Martin, Jr, told Congressmen last week he believed the House would act favorably on the company bill this year. Senate consideration, it is certain, will not come before next year.

Backers of the bill for federal construction were still in the fight last week. Democratic Rep Franklin D. Roosevelt, Jr, of New York tagged the company bill as another "give-away" and added that it was just another part of the Republican program to dispose of the resources of the nation.

Roosevelt's office hinted that the New York Congressman may launch an all-out attack on backers of the company bill with particular emphasis on the nationwide advertising campaign being carried on by the five companies.

Backers of the bill for state construction were silent. If Gov Thomas E. Dewey of New York had made any attempt to gain support in Congress for the state bill it was not apparent last week.

Interior Studies Changes in Proposed BPA Pact

At least one major change and several minor ones are being considered in the proposed company-federal power contract being negotiated for the Pacific Northwest (EW, June 15, p 123).

Major modification, which has tentative backing of Interior Secretary Douglas McKay, would restrict new industrial loads to be taken on by electric companies purchasing federally produced power. As drafted the contract restricts publicly owned utilities from picking up new customers which would have power requirements of more than 10,000 kw in any one year.

Another proposed change would make some concession to industrial customers now being served by Bonneville Power Administration. Under the draft contract, it would be almost impossible for these customers to appreciably increase their demands on BPA-priced power.

Government spokesmen last week were not ready to say when the proposed contract between BPA and Portland General Electric Co would be signed.

However, McKay has indicated it may take a week or more of negotiations. Once signed the contract will be a model for government power contracts with eight other electric companies in the BPA area.

Representatives of the electric companies, BPA, and BPA's industrial customers met with Interior Department officials in Washington recently for lengthy discussions of the proposed contract.

Other items in the week's news will be found starting on page 159.

PHILO STATION of Ohio Power Co, where the new 4,500 psi, 1,150F- 1,050F- 1,000F double-reheat unit is to be installed, is located near Zanesville. Built in 1924, Philo Station now houses five units totalling 415,000 kw. New unit will be a 125,000-kw machine

4,500 Psi—1,150F—1,050F—1,000F at Philo

A New Power Generation Milestone

A bold forward step in power generation economics advances the frontier cleared by Twin Branch, Tanners Creek, and Kanawha River Plants of American Gas & Electric Co.

PHILIP SPORN, President, American Gas & Electric Service Corp, New York

The remarkable record of the utility industry in not only keeping up with demands and needs of the country for increasing amounts of electric power during the past 12 years, but also doing so at substantially static or even declining rates in the face of a doubling or more of almost all other indices of cost in the same interval is due to a larger number of basic causes. High in order of importance among these has been the progress made in developing modern and more efficient techniques in building and operating generation facilities. While the use of higher steam pressures, higher temperatures, reheat and higher reheat, larger units, and single boiler—single turbine unit system designs all date back to the thirties, the principal steps forward were all taken within the past 12 years.

But it has been evident for some time that a flattening out in this curve of progress was rapidly setting in unless new avenues of approach and of progress were opened up. The more the problem was studied by the engineers of Babcock & Wilcox Co, General Electric Co, and American Gas & Electric Service Corp, the more clear it became that any significant progress now that would at the same time open up the way for further progress in the years ahead lay in breaking away from present conventional design limits and limitations in pressures, temperatures, and reheat, and thus from the limitations on further reductions in capital costs of generating plant facilities.

This approach has culminated in a new unit embodying many new and forward-reaching ideas in the technology of economic generation of steam electric power which has been ordered for the Philo Plant of Ohio Power Co, one of the three principal groups in the AG&E System. Background work for this unit includes more than 30 years of experience within the AG&E System and a continuous program of cooperation and research with General Electric and Babcock & Wilcox.

Management of these companies decided that it was time, and that it would be advantageous, to install a commercial scale unit as moderately sized as could be practically built. This would embody the many new developmental ideas and the most

advanced technology in order to obtain experience in the design, manufacture, construction, and operation of all the equipment involved, before proceeding on and making the next large and significant step in improving steam generating station economy and economics.

It is interesting and fitting that this new step toward more economical power generation should be made at Philo Plant because it was there that one of the earliest steps in this direction, the installation of a 600 psi reheat unit in 1924, was made.

Between 1924 and 1953 the first 1,200-psi reheat unit was installed at Deepwater (1930); the 2,300 psi reheat unit was installed at Twin Branch; the 2,000-psi, 1,050F/1,000F reheat units were installed at Philip Sporn and Tanners Creek; and the 2,000-psi, 1,050F/1,050F Kanawha and Muskingum units were designed and the first of them put into operation. All of these resulted from the collaboration of the three companies which have now brought together their know-how and experience to make possible this new forward step in power generation.

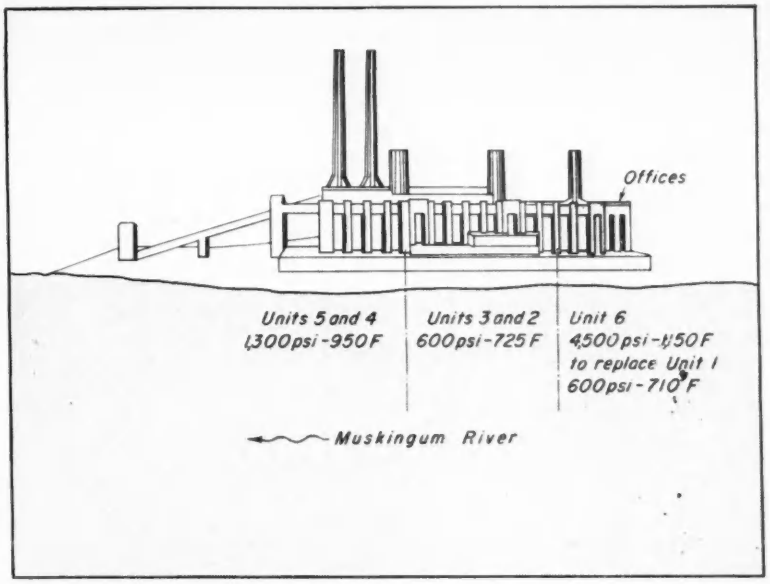


Fig 1—ELEVATION OF PHILO PLANT showing where new unit replaces 40,000 kw unit

New Concepts . . . While many new concepts will be included in this developmental unit, the following will be particularly outstanding:

1. A new high in boiler and turbine operating pressures. Both the feedwater inlet pressure of 5,500 psi and the turbine throttle pressure of 4,500 psi constitute not only new highs in their respective classes but are approximately double any pressures previously developed commercially.

2. The pressure employed is well above the critical pressure of 3,206 psi, thereby requiring the unit to be of the once-through type, eliminating the need for the heavy and costly drums found in conventional evaporative boilers.

3. A new high in main steam temperature of 1,150F, 50 deg higher than anything previously built.

4. Double reheat to further increase operating efficiency.

5. Cyclone furnaces of the type developed by Babcock & Wilcox.

6. A new design of feed pumps to deliver feedwater at 5,500 psi.

7. As a result of these design features and others, a new high in overall plant thermal efficiency of more than 40% has been achieved. This

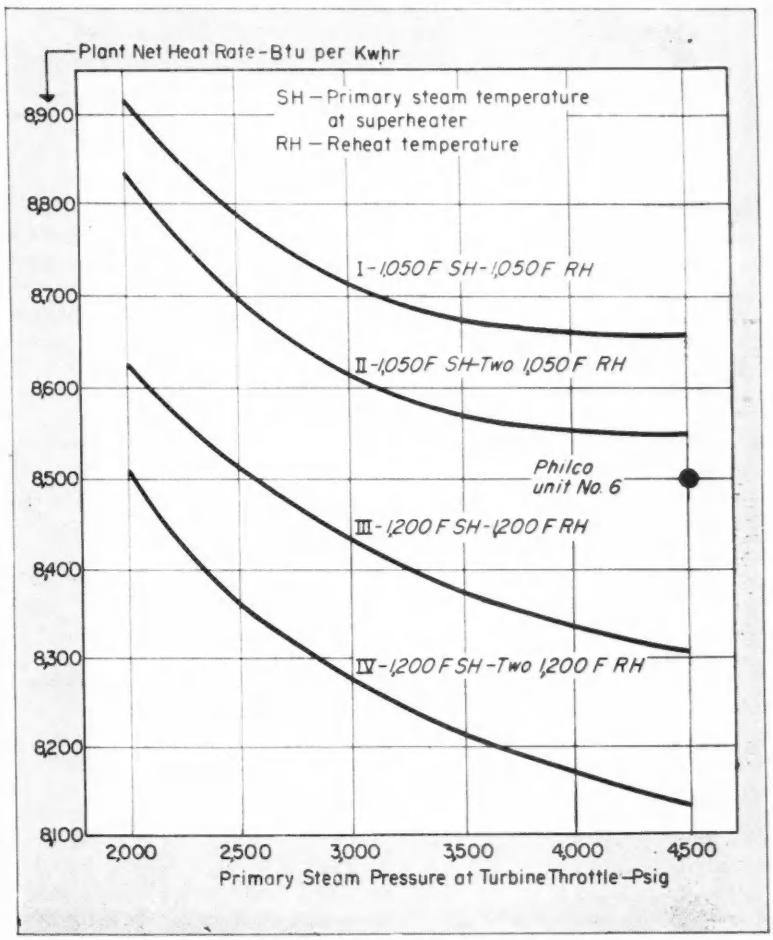


Fig 2—EFFECTS of increasing temperature and pressure, on overall performance. Increasing temperatures permit increasing gains in efficiency by going to higher pressures, but at the 1050F level no appreciable gain in efficiency can be had above 4,000 psi. But as temperatures approach 1,200 F, gain can be had by going to 5,000 psi

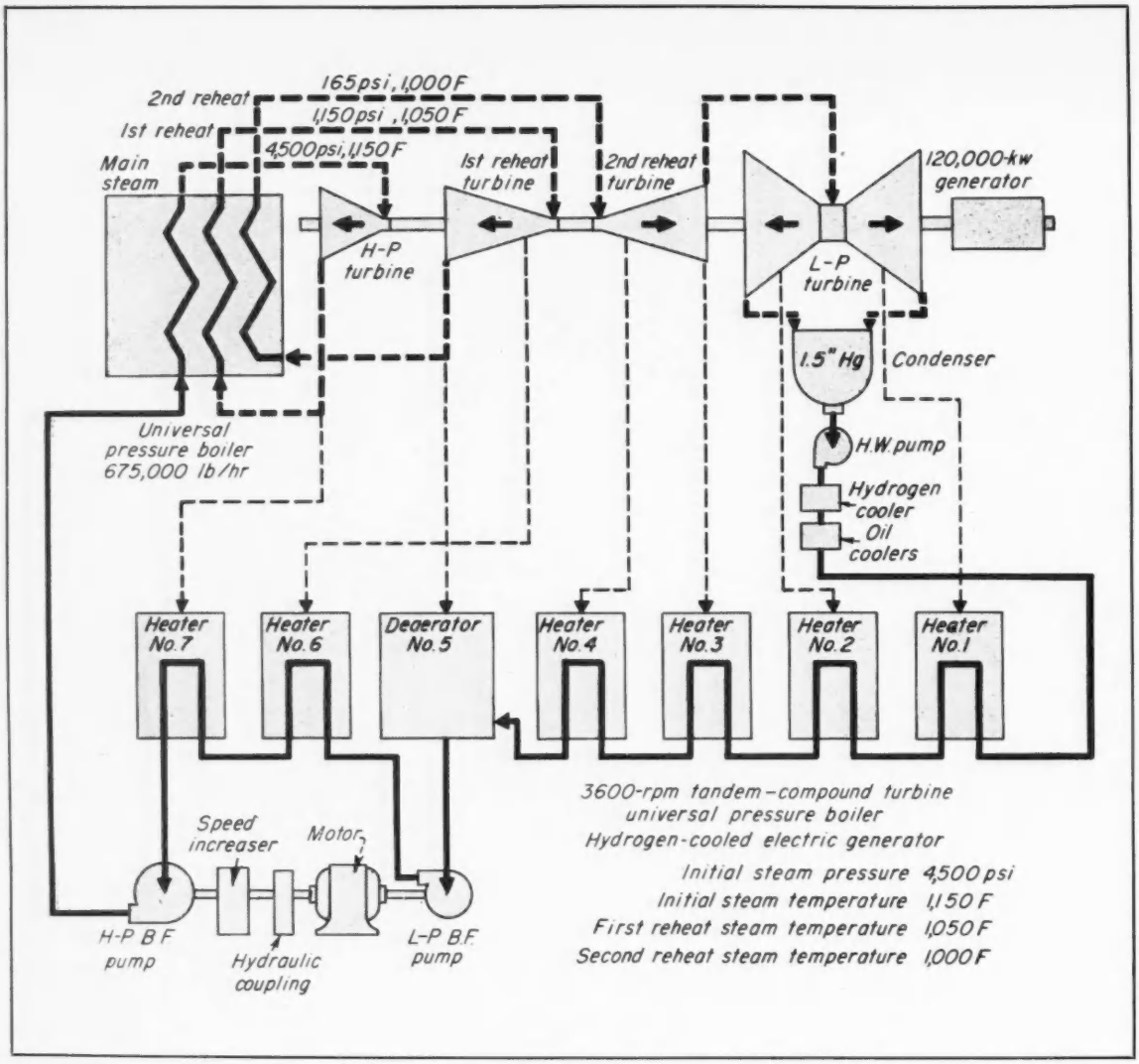


Fig 3—DIAGRAM of preliminary super-critial pressure steam cycle to be used in connection with the 4,500 psi 1,150F-1,050 F-1,000 F Philo Unit

compares with the 1951 average for the U.S.A. of 25% and the best plant performance in 1952 of 36.68% at the Tanners Creek Plant of the Indiana & Michigan Electric Co on the AG&E System.

Philo Location Is Central . . . This new unit will be located at the Philo Plant near Zanesville, Ohio, for several reasons. This plant is centrally located on the AG&E System and is close to many heavy industrial load centers. The fuel price in this area is attractive. Because of the high efficiency of this unit it will be possible to replace a 40,000-kw turbine generator set installed in 1924-1925 without appreciably increasing the cooling water requirements at this location where its availability is somewhat limited. The general manner in which this new unit will fit into the existing plant space occupied by the old 40,000-kw unit is shown in Fig 1.

Steam Cycle Indicates Progress Ahead . . . Increases in thermal efficiency, in part, have been obtained over the past years by continually increasing initial temperature and pressure. Fig 2 shows that increasing temperatures permit increasing gains in efficiency by going to higher pressures, but at the 1,050F level no appreciable gain in thermal efficiency can be made by going higher than approximately 4,000 psi. However, as temperatures approach the 1,200F level considerable gain can still be obtained in going to 5,000, 6,000 or even 7,000 psi with units of large capacity. The cycle chosen thus will not only exploit a favorable combination of higher pressures and temperatures but will also establish an experience mark in anticipation of the higher pressures and higher initial temperatures which are inevitably coming.

The proposed cycle layout itself is shown in Fig 3. It is still in preliminary form and may possibly be somewhat altered in the final design shakedown. Aside from the high temperature and pressure involved, some of the salient features are these: double reheat, seven stages of feedwater heating, and low and high-pressure feed pumps. Main steam flow will be in the order of 675,000 lb per hr.

All auxiliaries will be motor driven. A net overall plant heat rate in the order of 8500 Btu per kwhr is expected.

First Commercial Installation . . . A Universal Pressure steam generator will be furnished by Babcock & Wilcox to supply steam for this new high pressure—high temperature cycle. This will be the first time that this type of steam generator will be used in a commercial installation in this country. It is of the once-through type into which water is pumped at one end and out of which superheated steam is taken at the other end. Although the steam generator acts like a single continuous tube from one end to the other it is made up of many sets of tubes in parallel. To assure the uniform and predictable distribution of water between these many passes a high pressure drop of 1,000 psi is taken between the feedwater inlet header and the superheater outlet header. At full load feed pumps (described later) must, therefore, supply water to the feed header at 5,500 psi. To withstand these tremendously high pressures the entire high pressure side of the steam generator except the headers is made up of small diameter tubing of considerable thickness, varying in composition from carbon steel at the inlet to stainless steel at the outlet.

As this is a once-through type unit, there is no need for the usual high static head to provide circulation and separation of the steam and water. The steam generator can thus be arranged in a very compact manner, resulting in an appreciable reduction in building volume. This represents one of the major advantages inherent in this type of equipment.

The steam generator is rated to deliver 675,000 lb per hr of steam at 4,500 psi and 1,150F, as well as reheat approximately 615,000 lb per hr of steam at 1,150 psi and 800 F to 1,050F, and 525,000 lb per hr of steam at 165 psi from 630F to 1,000F. The high figure of 81% of the total heat input to fluid in this apparatus will be utilized in the superheating of steam in the main superheater or in the reheaters. It is apparent why the term "boiler" is no longer applicable to this equipment.

Cyclone Furnaces Will Be Used . . . Crushed coal will be fired to this unit through three Cyclone furnaces of the type recently developed by Babcock & Wilcox. Liquid slag will be tapped out of these Cyclones into the small primary furnace into which the Cyclones fire and thence to a water filled slag tank. Gas leaving the primary furnace will be mixed with cool recirculated gas to give a gas temperature of 1,900F before entering the convection surfaces. This will insure clean surfaces in the convection pass. The gas leaving the convection surface of the reheaters and the superheater passes partly to the recirculation fans and mostly to a tubular type air heater and thence to the induced draft fans and the stack. No separate flyash removal equipment is provided because the Cyclone furnaces will remove all but a small amount of exceedingly fine ash which will be easily dispersed by high stack velocities.

Pressure in the steam generator will be controlled solely by the discharge pressure of the feed pumps. A pressure regulator at the turbine throttle will therefore control pump speed rather than firing rate as in other installations. Heat input to the unit will be controlled primarily by main steam flow and temperature. Temperatures at the two reheat points will be controlled by the interaction of dampers in the gas passes leaving the reheater and superheater surfaces.

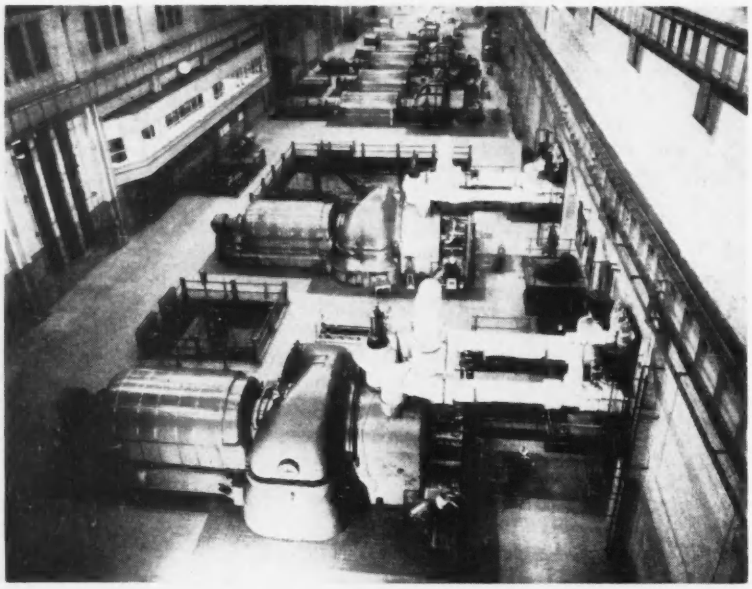
Special provisions must be made for starting and transient conditions expected with this steam generator. To do this, recirculation valves with pressure breakdown orifies will be provided to permit fluid circulation through the unit during these times. The fluid circulated through these valves will flow to the deaerator which in turn will pass any excess heat in the form of saturated steam to the condenser for removal from the cycle. Carefully controlled desuperheating arrangements will be required to prevent excessively high temperature steam from reaching the deaerator or the condenser. Operation of these recirculation valves will be automatic to provide the protection necessary during transient conditions. No provision will be made for circulation of steam through the reheaters during startup due to their location.

Turbine Generator Is Unusual . . . A turbine generator to convert the energy of this high temperature-high pressure steam into electricity will be manufactured by General Electric. The machine will operate at 3,600 rpm with a special, high-pressure turbine in tandem with a machine of the reverse flow type developed by GE. Steam at 4,500 psi, 1,150F will flow through four steam leads from the steam generator to four pairs of stop and control valves located under the front of the machine. The control valves will be throttling valves to vary load on the machine by varying steam pressure to the first stage.

At full load steam will be exhausted from the high pressure turbine at 1,225 psig and will return to the steam generator where it will be reheated to 1,050F. It will then re-enter the midsection of the high pressure rotor of the reverse flow type section and turn forward through several stages before exhausting to the second reheater at 185 psig. The steam then will return at 1,000F to the mid-section of the turbine adjacent to the inlet from the first reheater and flow through several stages before crossing over to the double flow low pressure section. Intercept valves will be provided in each of the two hot reheat lines to protect the machine from overspeeding in the event of a tripout.

Because of the high temperature the stop valves, control valves, steam leads, flanges, and part of the inner shell of the high pressure machine will be constructed of austenitic material. Studies are now being made by General Electric to determine whether the rotor of the high pressure machine can safely be made of ferritic material with provision for steam cooling or whether it will be necessary to include some type of austenitic material in the highest temperature zones. The high-pressure machine will utilize the now common double shell construction which allows the lower temperature part of the inner shell and all of the outer shell and its fittings to be made of the more available ferritic materials. The turbine from the first reheat point to the condenser will be fabricated entirely of ferritic material.

Turbine Controls Complicated . . . The controls of this turbine will be more complicated than on a conventional machine to the extent that two sets of reheat stop and intercept valves must be provided. Another special feature required will be an initial temperature regulator. This device will sense the steam temperature at the



UNIT IN FOREGROUND is one of the early reheat units. Installed at Philo in 1924 it is rated 40,000 kw, 600 psi. It will be removed to make room for the new 125,000 kw, 0.85-pf 4,500-psi double-reheat installation. Philo Plant is on the Ohio Power Co system

turbine throttle, or some indication of that temperature, and will close the control valves in the event that the temperature drops either too low or too fast. This will protect both the steam generator and the turbine by preventing conditions such as the sudden carryover of water in the event of loss of fires. The protection that this equipment will provide is similar to the protection that an initial pressure regulator provides on a conventional boiler.

The generator for the unit will be hydrogen cooled, with facilities for operation at 30-psi gas pressure to obtain maximum rating. A tentative maximum rating of 125,000 kw, 0.85 pf has been selected. The necessity for installing this machine in the space now occupied by a much smaller generator compels that it be designed to save space. Investigation is being made of the possible shortening of the generator rotor by utilizing direct cooling of hollow conductors; likewise a study of the design of the stator for obtaining minimum length is being carried out. All of these will affect the determination of the final voltage rating to be adopted. A rotating exciter, using an amplidyne voltage regulating system, will supply excitation for the unit.

The machine will be connected directly to a single, 3-phase step-up transformer with forced-oil, forced-air cooling. It will be connected on its high side to the 132-kv station bus. The normal station auxiliary supply will be taken directly from the generator leads. A step-down transformer will be provided to furnish auxiliary supply for starting or emergency purposes. This transformer will take its power from the 132-kv station bus.

The larger and more important station auxiliaries will be operated at 4,000 v, with the smaller equipment connected to a 550-v auxiliary bus. The neutral of the generator winding will be grounded through a distribution transformer with a resistor connected across the secondary winding. Lightning protection will be provided for the high side of the step-up power transformer, and following latest accepted practice, surge protection will be omitted from the generator.

Two Feed Pump Arrangements . . . Feed pumps to supply the 5,500 psi pressure water required by this cycle will be manufactured by De Laval Steam Turbine Co. At present two alternate arrangements of pumps are under consideration. Both will provide two sets of pumps, each set having a capacity of 60% of full load flow and having variable speed hydraulic couplings for the regulation of turbine throttle pressure. The two arrangements being studied are as follows:

1. Low (LP) and high (HP) pressure feed pumps as shown schematically in the cycle diagram, Fig. 3. Feedwater is taken from the deaerator by two constant-speed, barrel-type feed pumps of conventional design and pumped to approximately 2,000 psi. The water is then fed through the two top feedwater heaters and heated up to approximately 515F. It next enters the two newly-designed 6,500-rpm, variable-speed, barrel-type pumps which boost pressure to 5,500 psi.

Each set of pumps is driven by a common motor, that is, one end of a motor shaft is coupled to one of the constant-speed LP pumps, and the other end is coupled to the variable-speed coupling and step-up gearing driving one of the HP pumps. This arrangement has the advantages of eliminating 5,500-psi heaters as well as their 5,500-psi piping and valves. It has the disadvantage, however, of the requirement of pumping hotter water, with its slight thermodynamic loss, and of requiring in effect twice the number of pumps, with the attendant increase in first cost and maintenance.

2. The other arrangement under consideration calls for the feed pumps to be single, high-speed pumps located under the deaerator and pumping the feedwater through two high pressure heaters at 5,500 psi. This makes for a simpler arrangement but calls for the development of feedwater heaters to stand the very high water pressure as well as for the use of additional valves and piping good for this pressure.

Further studies are continuing on the economics of these two arrangements. A final decision will be made soon.

Feedwater Heaters Offer a Choice . . . The feedwater heaters in this cycle will be more or less conventional if the arrangement of feed pumps described as alternate 1 above is utilized. On the other hand, two high-pressure heaters of new design will be necessary if alternate 2 arrangement is selected. European as well as B&W experience clearly indicate that the pH of the feedwater should be kept high, around 9.2 to 9.5. This means that all feedwater heaters must be provided with tubes which stand up under these conditions. The deaerator, operating at approximately 175 psi, will have to receive special de-

(*Continued on page* 138)

Company Opens Public Picnic Grounds

A new picnicking ground has been opened to the public by the Carolina Power & Light Co. The site is a bluff overlooking a broad bend in the Cape Fear River, about 5 miles north of Wilmington, N. C.

The spot once was called Mount Misery (a place of exile for recalcitrant slaves, according to legend). Until the company started a power plant nearby and built a road, the stop was accessible only by boat or a jeep.

The company has built a large pavilion and outdoor fireplace (see papa trying to build a fire above) and has installed tables and benches, water fountains, toilet facilities. There is a large asphalt-paved parking lot. For those desiring to come by boat the company has added a 40-ft pier.

Georgia Power Aiding Cleveland Go Industrial

Cleveland, the North Georgia mountain town in which the movie, "I'd Climb the Highest Mountain," was filmed, is out to remake its face and become attractive to new industry. The inspiration for this drive is coming from the Georgia Power Co.

Back in 1948 Cleveland won the company's Champion Home Town Contest. The people realized what they could do working toward an objective and soon had Talon, Inc, convinced that it should locate a zipper plant there. Then the city asked Georgia Power for assistance, and Georgia Tech was sold on the idea of using Cleveland as a testing ground for civic improvement.

Results so far are more than just promising. An entirely new plan has been developed. A new town square and the surrounding business buildings are being designed to conform to modern concepts. Rezoning of old residential districts and the laying out of new ones to conform is underway. And there will be areas set aside for industrial plants.

One of these will be a $2-million woolen mill of Ames Textile Corp, Lowell, Mass. City officials believe that in the near future a number of other firms can be attracted.

Trees Get OK . . .

. . . from Pacific G&E in a program designed to get customers to plant the right ones

Trees may be beautiful but often they are not. In addition they frequently are the cause of great trouble and expense to electric utilities. Pacific Gas & Electric Co believes it has the solution to these problems. It has started a program to gain public support for the adoption by city and county governments of ordinances governing tree planting.

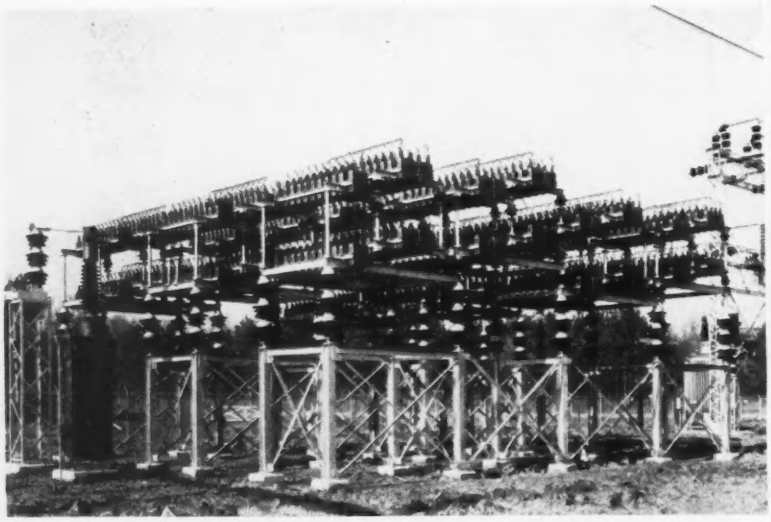
Booklet "Kicks Off" Campaign . . . To launch the new civic service, PG&E has issued a 16-page booklet, illustrated in four colors, and entitled, "Trees to Fit Your Home and Your Street." Copies will be presented to officials of city and county governments, park superintendents, landscape architects, real estate developers, garden club and neighborhood improvement club officers, and other leaders.

An excerpt leaflet from the booklet will be distributed to the public through local company offices. The leaflet contains photographs in full color of 20 especially recommended trees. It also names trees that should be avoided.

In addition a set of film slides has been prepared as the basis of illustrated lectures.

All details of the program, including the booklet and slides, were developed with the collaboration of the Saratoga Horticultural Foundation, a shade tree experiment station in Santa Clara County, and leading arborists.

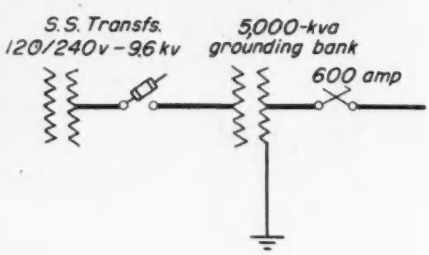
Steps of Plan Listed . . . The booklet outlines the following steps for the development of a comprehensive community street tree plan: A survey of existing trees, noting bad trees to be replaced; preparation of an official list of trees adaptable to local conditions; making a master plan of trees for all streets; establishing an ordinance controlling the planting, maintenance, and removal of all street trees; development of a financing program; establishing a program for acquiring plant stock; and developing a program for planting and maintenance of street trees.



CAPACITOR BANK is one of two such 24,750-kvar, 110-kv installations at Back River Substation of Virginia Electric & Power. It serves NACA Langley Lab and part of Newport News

Advantages over synchronous condenser or combination condenser-capacitor installation

- **Lower Investment**
- **Lower Operating Costs**
- **Easier Maintenance**
- **Shorter Outages**
- **Less Installation Time**



Why Vepco Installed . . .

100,000 Kvar in Switched Capacitors at NACA

T. S. MARTIN, Asst Supervisor, Electrical Equipment and Transmission, Virginia Electrical & Power Co, Richmond

Four advantages over a synchronous condenser or combination condenser and capacitor installation led Virginia Electric & Power Co to put 100,000 kvar in switched capacitors at its 110-kv Back Bay Substation. This serves the Langley Laboratory of the National Advisory Committee for Aeronautics. The advantages:

1. Lower plant investment—approximately $9.50 vs $14 per kvar.
2. Less time to get equipment into full operation.
3. Lower operating and maintenance expenses—$21,000 vs $57,000 per year (estimated).
4. Greater opportunity to make repairs and carry out periodic maintenance without interfering with customer's operations.

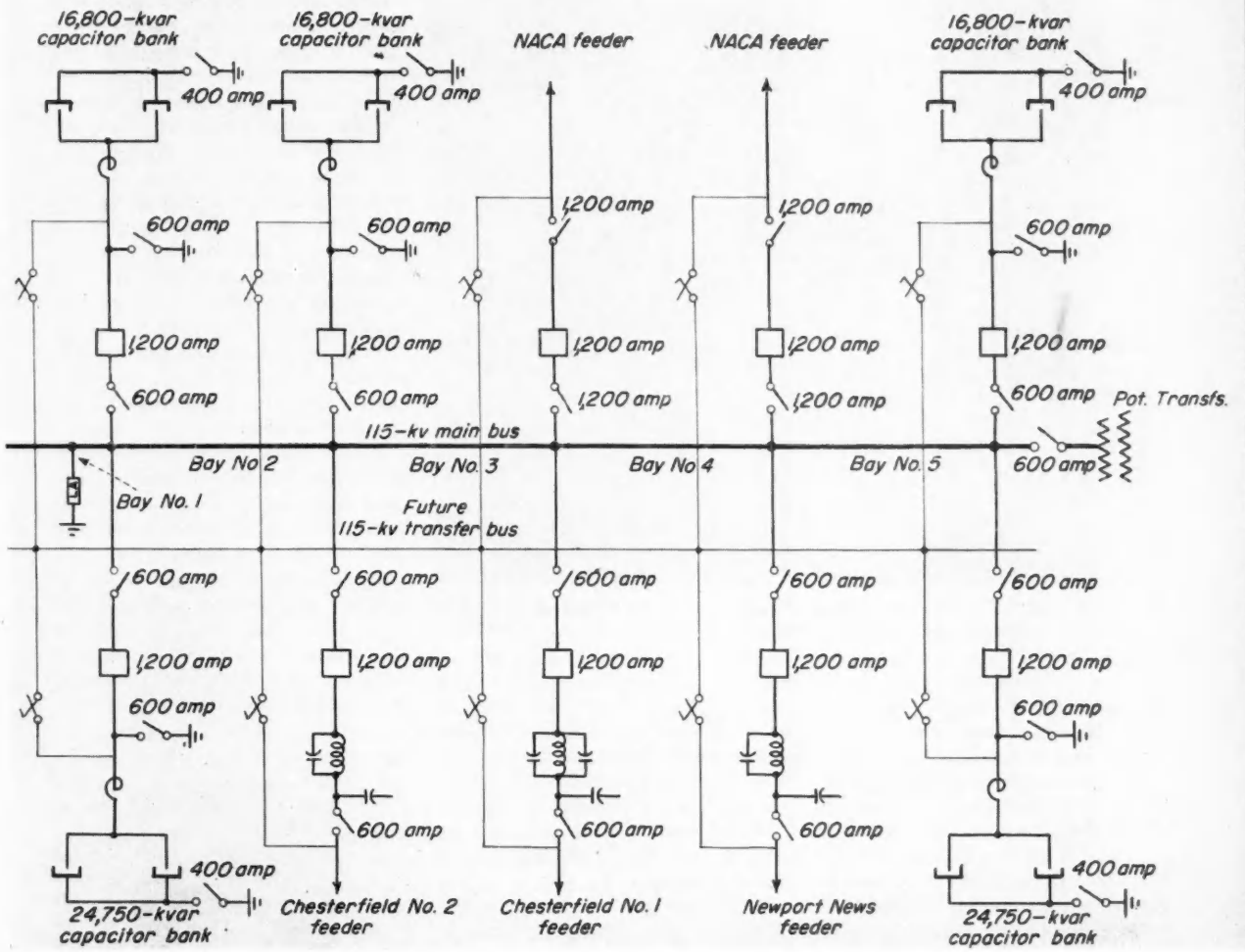
Under the contract Vepco must supply 70,000 kw firm and up to 100,000 kw if available and needed between 6 am and midnight, at other hours 150,000 kw firm.

Adapted from recent Southeastern Electric Exchange Paper

Voltage Limits . . . The contract specifies that voltage at NACA be held between limits of 105 and 110 kv and that power factor will be not less than 95% for off-peak demand of 150,000 kw or the on peak demand of 70,000 kw. Power factor may be lower than 95% for demands less than 70,000 kw. Approximately 50,000 kvar must be supplied to the customer at maximum load to meet this power factor specification. In addition approximately 50,000 kvar must be supplied back to company's transmission system to hold the voltage at 105 kv with a voltage of 110 kv at the generating stations. The reactive supply must be controlled to keep the voltage within the specified limits.

Synchronous Condenser . . . The possibility of having to supply power of this magnitude to the Langley Laboratory has been under consideration for a number of years and had received study from time to time before the new agreement was made between the company and NACA. It was considered that the var requirements should probably be supplied in part by a synchronous condenser and in part by switched static capacitors. The customer's requirements are for power at 110 kv, as this voltage is now being used.

It was impractical to install synchronous or static reactive supply sources at the voltage used by the customer's motor equipment as such sources of reactive would be available only when operating the particular laboratory facilities to which the reactive supply is connected. It had been planned tentatively to connect a synchronous condenser through a transformer to the 110-kv bus. The



ONE LINE DIAGRAM of Virginia Electric & Power Co's NACA Substation shows 115-kv transfer bus which is to be added at a later date

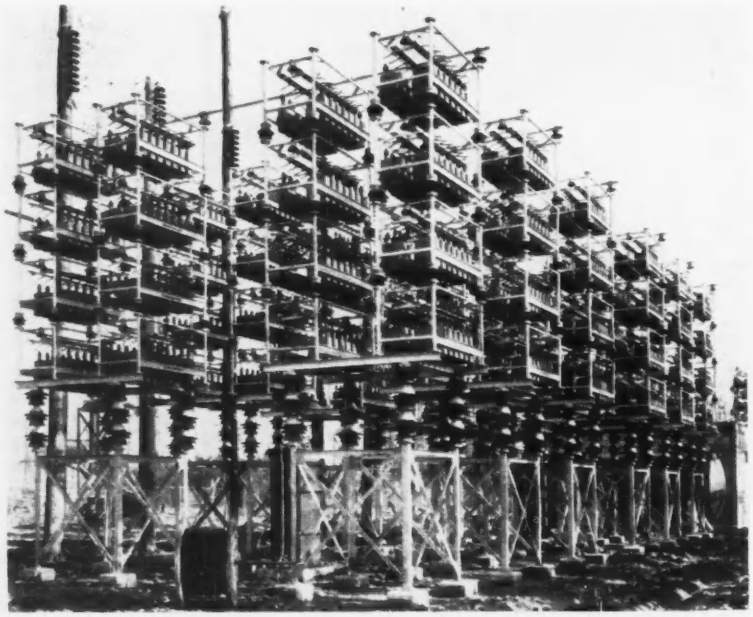
plans covered a condenser having a capacity of 60,000 kvar at 15 lb hydrogen pressure, a 60,000-kva, FOA transformer of 10% impedance, and two switched capacitor banks of approximately 25,000 kva each, made up of low voltage units in series-parallel and insulated for 110 kv.

Network calculator studies made subsequent to the agreement indicated that the lagging capacity of the synchronous condenser would not be needed to hold down the voltage at off-peak periods when the laboratory was not operating. Originally it was thought that the synchronous condenser with high speed excitation might improve the safety factor somewhat for steady state stability.

Operating Expenses . . . The power losses of transformers and synchronous condensers are quite small, but they are high compared with power losses of capacitors. For an installation of this magnitude the saving in losses by capacitors is quite substantial. Cost for maintenance of the synchronous machine and its associated transformer would also be quite high compared with maintenance cost for the capacitors and switching equipment. Operating expenses, including maintenance for the synchronous condenser-static capacitor combination, are estimated at $57,000 per year as compared with $21,000 for doing the entire job with static capacitors.

Outage Periods . . . Other advantages of the capacitor installation are that outage periods would be rather short and would involve a smaller portion of the reactive supply compared with outages for the synchronous condenser. As the maximum var capacity would only be required between midnight and morning, it is believed that one capacitor bank can be taken out of service for replacement of capacitors or maintenance of switching equipment without interfering at all with the supply of power. The synchronous condenser would be out at least biennially for one or more weeks.

Voltage Changes . . . Studies of the voltage changes resulting from switching capacitor banks indicated that switching a larger block than 16,000 or 18,000 kvar would result in objectionable voltage fluctuation when the customer's load was at a minimum value. The customer's equipment has synchronous motor characteristics, and the impedances of these machines are such that, at the maximum load of 150,000 kw, the voltage change from switching 30,000 kvar would be no greater than that from



AT THE NACA SUBSTATION at Langley Laboratory is this 16,800-kvar, 110-kv-capacitor bank along with two others of same rating. Bank has two wye-connected sections of 8,400 kvar

switching 16,000 kvar at minimum load. In other words, the reactance of the customer's utilization system at maximum load is only slightly greater than that of the company's system as viewed from the 110-kv bus at NACA.

Capacitor Banks . . . Taking into account both the sudden fluctuation of voltage due to switching and the requirement that the voltage be held within the limits of 105-110-kv, it was decided to install three capacitor banks of 16,800 kvar each and two of 24,750 kvar each. These sizes are selected to use standard capacitor units. The three small banks will be switched in first with the two large banks switched only when additional reactive supply is needed. It is proposed to use a combination of sequencing switches, changed manually about once a week, so that the number of switching operations on each of the small banks will be equalized and switching on the two large banks will be equalized with each other but not with the small banks. It is estimated that each small bank will probably be switched in and out about 1,600 times a year and each of the large banks 500 times a year.

Installation Standards . . . During recent years manufacturers have developed certain standards for high voltage, open rack, capacitor installations. These were established to meet certain desirable performance requirements. These requirements are:

1. The individual capacitor units should be protected by fusing with positive assurance that the fuse on a faulty unit will blow and prevent bursting of the can.

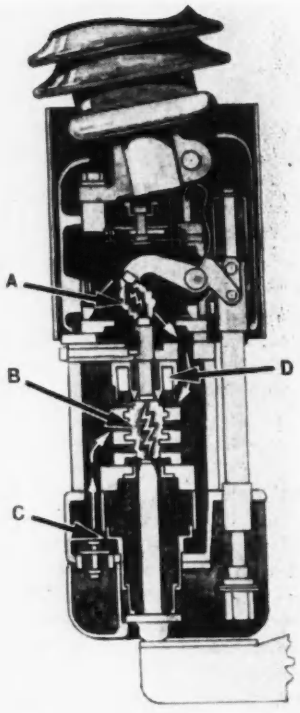
2. Failure of a single capacitor in a parallel group will not result in voltage exceeding 110% of nominal rating on the remaining capacitors of the parallel group.

3. Relay protection be provided to remove the capacitor bank from service in case of unbalances due to faulty units before the overvoltage damages other units.

The first two of these requirements can be met by selecting series-parallel combinations in such a manner as to provide a sufficient number of capacitor units in each parallel group. The third requirement involves connecting the capacitor phase groups in wye and using either voltage from the neutral point to ground or using voltage or current between the neutrals of two wye sections to trip the breaker at current or voltage magnitudes that would indicate unbalance of such magnitude that excessive voltage would occur on certain capacitors.

Switching Problem . . . The switching problem for capacitors is quite similar to that involved in switching long transmission lines when a single bank of capacitors is installed at one location on the system. In such cases, the inrush current is limited by the system reactance. The difficulties resulting from prestrikes on closing the switch are relatively unimportant compared with those that are involved in switching the capacitors off with possible restrikes. When the capacitor banks are installed in multiple on a bus, the inrush currents become extremely high in magnitude and at high frequency. In such cases the rates of rise of current may exceed 1000 amp per micro-second.

In the NACA installation, calculations made with an Anacom computer indicate that the inrush current would be approximately 28,000 amp at 12,000 cycles when 75,000 kvar of capacitors are already connected to the bus and the last bank, 25,000 kvar, is switched on. The prestrike in the breaker interrupter in this case will result in a shock wave producing bursting forces in the circuit breaker



OIL CIRCUIT BREAKER CONTACT of one manufacturer has a modified interrupter to control prestrikes and prevent breaker damage: A. Pressure generating break, B. Interrupting break, C. Oil flow piston for low current interruption, and D. Air cushion

interrupter many times greater than would occur on switching out a normal short circuit of the same current magnitude.

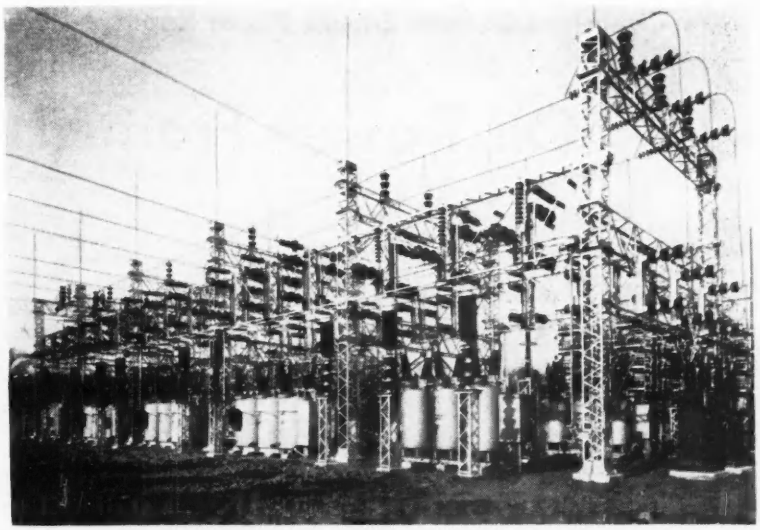
This problem arises because the 75,000 kvar of capacitors already charged will discharge into the uncharged capacitors with only the reactance of the bus available to limit the rate of inrush.

Two Manufacturers Supplied Equipment . . . The capacitor banks and circuit breakers for switching them at NACA were purchased from two manufacturers. Both have made tests on their circuit breakers to determine whether they would satisfactorily close the currents involved. One of the manufacturers established a test circuit to produce the equivalent of the calculated value of 28,000 amp at 12,000 cycles and found that certain modifications would be necessary to control prestrikes and prevent damage to the breaker.

The other manufacturer's breaker was tested at the equivalent of 18,000 amp and 8,000 cycles. This was the value calculated by this manufacturer for the inrush current. Approximately 50 closing tests were made at currents of this magnitude and frequency, and this manufacturer is satisfied that his standard breaker will satisfactorily switch the currents that will be involved at this installation.

Inrush Currents . . . Both manufacturers have guaranteed that the performance of their breakers would be satisfactory without providing any intentional reactance to limit inrush currents. Shortly after the use of all switched capacitors for voltage control was decided and as soon as the magnitude of the inrush current switching problem was realized, it was decided to install reactors to limit the inrush.

The first idea was to use a standard carrier current wave trap with the capacitor pack and lightning arrester omitted. The standard wave trap normally has a single suspension insulator located within the ceramic form to carry the line tension when connected in a line or to keep the porcelain form in compression when the wave trap is mounted on bus insulators. It was recognized almost immediately that the voltage across the reactor would be in excess of the flash-over voltage of the single insulator and that additional insulation would be required at this point. One of the manufacturers was asked to work on the design of a suitable reactor for this problem. The manufacturer's studies indicated that increase in insulation would be required not only for the strain insulator but between turns of the reactor as well.



THIS VIEW of the 110-kv structure of NACA substation shows the 1,200-amp circuit breakers and the reactors in the foreground. In background can be seen station's capacitor banks

The inductance coil consists of a reactor wound on a grooved ceramic form similar to those used for carrier wave traps but using conductors of stranded copper approximately equivalent to 2/0, insulated with 7/64-in. rubber, covered by 3/64-in. special neoprene jacket. This reactor will have an inductance of 145 microhenries. One of these will be installed in each phase lead to each capacitor bank between the oil circuit breaker and the capacitor. By use of this additional inductance, the inrush current on switching in the last capacitor bank will be reduced to about 12,000 amp at 3,500 cycles.

Capacitor Arrangement . . . The arrangement of capacitors to produce a 16,800-kvar bank consists of two wye-connected sections of 8,400 kvar each. The star points of the two sections will be connected together by a 110-kv current transformer which will have a ratio of 1 to 2.5 amp secondary. This current transformer will operate a relay to trip off the bank in case of unbalance that would result in excessive voltage across a portion of the capacitor bank. Each phase of each 8,400 kvar section will have eight groups of capacitors in series. Each of these groups will consist of 14 capacitors in parallel with each capacitor rated 25 kva, 7,960 v. Each wye leg consisting of eight 7,960-v sections in series would have a nominal voltage of 63,680 resulting in a phase to phase voltage of 110,400. Each bank is rated by the manufacturer at 16,800 kvar at 108 kv by taking advantage of the plus tolerance available in the individual capacitor units. With this arrangement two capacitors in the same parallel group can fail without resulting in the voltage on the remaining units exceeding 110% of rated voltage if the bus voltage at the time is not in excess of 108 kv.

Large Banks . . . Each of the larger banks will also be made up in two wye sections with each leg of each wye section having 15 groups in series, with each group consisting of 11 capacitors in parallel, each rated 25 kvar at 4,160 v. The nominal voltage ratings of the individual capacitors in this case will result in a bank rating of 108 kv. Loss of two capacitors in the same parallel group will, in this case, result in voltage in excess of 110% on the remaining capacitors of that group, and the bank must be switched out. This unbalance will, in this case, also be detected by a relay operated from a current transformer connected between the neutral points of the two wye groups.

Dow Chemical-Detroit Edison Team Reports . . .

On Power From the Atom

Proposes project financed by private capital and based on plutonium valued at its worth as a fuel rather than as a munitions component. Liquid-metal-cooled fast breeder reactor to provide high coolant temperature, 950 to 1,100F, for efficient power production. Steam would be 2,200 psig, 900F, generator capacity 135,000 to 200,000 kw with either one or two units. Many problems remain to be solved. Cost estimates are not available, but exclusion area alone, under present rules, may cost 50% of present total cost of steam plants.

Objective of Dow Chemical-Detroit Edison's nuclear research team was a system that would produce power at a cost competitive with coal. The study was conducted on the assumption of a plutonium price equivalent to its value as a fuel rather than as a munitions item. With this as its objective, the team's efforts were directed toward the use of known nuclear technology plus development and test work that would provide the information essential to the design, construction, and operation of a nuclear reactor for the production of power at competitive costs.

Breeder Reactor . . . This team's research has concentrated on a liquid-metal-cooled fast breeder reactor which will provide the high coolant temperature necessary for efficient power recovery. In the design for initial investigation ideal fuel mobility will be compromised by the use of solid fuel elements of a uranium alloy. With the solid fuel elements the aim will be simplified fabrication and ready adaptability to the metallurgical processing. It is planned to use uranium, in some form of metallic uranium or uranium alloys to simplify processing requirements, in the breeder blanket to produce plutonium.

A design embodying these features is being undertaken on a preliminary basis. Research and development work on the project is being conducted by AEC and in private laboratories.

Preliminary Design . . . It is proposed that this preliminary design will include a cylindrical core reactor of the breeder type. The reactor will be made up from multiple sections into which a low-melting-point, enriched uranium or plutonium will be cast, permitting fuel to be processed for plutonium and fission by-products in the molten state. Fuel sections will be reconstituted by a remote control casting process.

The blanket will consist of a depleted uranium alloy which will be cast in multiple sections, cooled by sodium, and processed and reconstituted in a manner similar to the core.

The reactor heat output will be in the order of 450 to 600 Mw.

Sodium Cooled . . . Sodium, the primary coolant, will be circulated through the core and blanket at the rate of 20,000 to 27,000 gpm with inlet temperature 400F and outlet temperature 1,000F. At present, it is proposed to use an intermediate heat exchanger to transfer heat from the primary sodium coolant to a secondary NaK coolant system, in order to elminate the possibility of the presence of radioactive sodium in the steam generation system.

Steam—2,200 psig, 900F . . . Several steam cycles are under consideration. One of these, which will not necessarily be the final design, will deliver steam to the turbine at 900F, 2,200 psig, and at a net station thermal efficiency of about 30%. There will be either one or two generating units totaling 135,000 kw to 200,000 kw.

The first reactor may be built and tested before generating equipment is installed.

The fuel processing plant will be integral with the reactor. The reactor will be shut down weekends for processing parts of the core and blanket in order to cut down on the expensive inventory of fissionable material.

No significant figures are available on costs and no firm estimates can be made on time schedule.

Much of the technical data required are being worked out in government supported laboratories. This research requires unique facilities which are expensive and should not have to be duplicated by private industry at this time.

Private Financing . . . Objectives of the Dow-Detroit project are based on the assumption that the reactor installation would be financed and owned by private capital in a manner similar to other private industry activities using private funds and without making it necessary for the government to supply capital.

Specifications . . . Studies by this team resulted in some conclusions as to the most important specifications for an economical power reactor. On the basis of these conclusions a reactor should:

1. Utilize low cost fuel, ie, it should be a breeder reactor which within itself converts thorium or depleted uranium to fissionable material for fuel. A breeder reactor is taken to mean a machine which produces more fissionable material than it burns, whether it is the same or a different material.
2. Have a high breeding gain, ie, be a fast-neutron reactor to produce an excess of fissionable materials above its own fuel requirements.
3. Be a high temperature machine if it is to produce power as well as fissionable materials. There appear to be possibilties of reaching the range of 900 to 1,100F in the reactor core.

Table I.—Reactor Configurations

Case	A-1	A-2	A-3	B	C
Fuel	Liquid	Slurry	Liquid, solid fertile material	Solid	Liquid
Coolant	Liquid	Liquid	Liquid	Liquid	Liquid
Max heat output, kw heat	25,000	460,000	75,000	450,000	220,000
Max coolant temperature available for steam generation, Deg F	900	1,020	900	1,020	930
Electrical power output at 30% efficiency, kw electricity	7,500	138,000	22,500	135,000	66,000
Coolant material:	Na	Na	Na	Na	Na
Melting temperature, Deg C	98	98	98	98	98
Boiling temperature, Deg C	883	883	883	883	883
Thermal conductivity, Cal/ cm/sec/ Deg C	0.15	0.15	0.15	0.15	0.15
dc, cal/cm³/ Deg C	0.24	0.24	0.24	0.24	0.24
Max circulating velocity, ft/sec	30	30	10(30)	30	30
Temperature rise, Deg C	130(260)	130	140	280	300
Max temperature, Deg C	480(610)	480	480	550	500
Min temperature, Deg C	350	350	340	270	200
Limiting factors: Specific power	High heat release per unit volume in fuel requires extremely small fuel elements or large temperature drops	pc_p of coolant	High heat release per unit volume in fuel requires extremely small fuel elements or large temperature drops	pc_p of coolant	pc_p of coolant
Max coolant temperature limited by	Corrosion	Corrosion	Corrosion	Corrosion	Corrosion

4. Permit integration with an extraction process to provide fast, low-cost separation and recovery of fissionable materials and fission products.
5. Require a minimum exclusion area. An improvement could be made by continuous removal and segregation of the fission products. Separation processes mentioned offer promise in this direction.
6. Use uncanned fuel, preferably mobile or fluid fuel.
7. Be inherently self regulating.

Dow-Detroit concluded that results from the work of AEC indicate that several of the major improvements in these objectives may be attainable. For example, the possibility of breeding and the high breeding gain of the fast reactors are contemplated. Both are generally accepted theories.

A materials producing reactor of these known types, with power producing capabilities, can be built now. However, it probably would be operated for optimum materials production, because of a greater value of the materials, until a reduced demand for weapons material makes the power potential a more important source of return.

Breeding . . . The Dow-Detroit team concluded that a commercial future for atomic power appears to be dependent on the development of the breeder reactors. From an economic viewpoint, the potential net gain in fuel in the breeder reactors promises a margin to offset the high investment cost of nuclear reactors as a source of power. At the present time nuclear power is handicapped by high capital costs, high processing costs, and significant fuel costs. If breeding is feasible, higher costs associated with nuclear power may be compensated by the sale of surplus fissionable material as fuel. The markets for this material should exist at one price level as set by the demand for weapons and eventually at a lower level as set by the demand for fuel for additional stationary and mobile power plants. Any credit for fissionable material should be at the lower level.

Low-Cost Integrated Processing . . . The desirability of a reduction in chemical-processing and fuel costs indicates the need for a fluid fuel and a closer intergration of the reactor and the separation and decontamination processes. The expense of fixed fuel elements, limitations set by them, difficulties of charging and discharging them, aqueous separations process, and the excessive waste volumes are large factors in nuclear economics. If the goal of flowing a fluid fuel through a reactor with the concurrent development of a lower-cost, integrated, continuous separations process can be reached, an important improvement will have been made in the search for nuclear power.

Mobile of Fluid Fuels . . . Information available indicates several possible categories of fluid fuels:

1. Eutectics of uranium or of plutonium with melting points of approximately 500C and higher.
2. Slurries, such as the dispersion of certain intermetallic compounds or alloys of uranium in low point alloys.
3. Fused salts.

All of those possibilities introduce serious development problems dealing with containers, radiation, stability, reproducing, and others.

It must be concluded that much development work is required on any of the fluid-fuel systems as well as on a reactor design in order to make use of them. To select a reactor which can be built in a resonable time,

it seems preferable to use the fuel in solid form.

If solid fuel must be used, then the fuel elements must be of such form or shape that they may be fabricated by remote control. Fuel elements which can be cast from molten metal should satisfy this requirement.

Exclusion Area . . . As to the requirement for a minimum exclusion area, it is considered desirable to locate the initial reactor within the distribution territory of the Detroit Edison Co. Under the present exclusion-area rules and considering the price of land in this territory, the cost of the exclusion area per kilowatt of electricity could amount to 50% of the present total cost of steam plants. Continuous removal of the products may improve exclusion area rules.

It is probable that at least the first few reactors built will require an exclusion area large enough to be a critical factor in the total cost. Assuming this to be the case, location of the reactor offshore, for example, in a body of water adjacent to the distribution territory may be an economical means of providing this area. There are obvious disadvantages to such a location, but it is suggested as a possibility. The combination of savings in site location that can be made by this plan and the improvements which appear to be within reach in the reactor and the separations processes offer the possibility that heat delivered to the turbine throttle may be competitive with coal.

Reactor Types . . . A number of mechanical reactor design types are conceivable which might meet all or part of the desired requirements. Some possible designs are these:

1. A jet-mixed centrifugally separated liquid-cooled reactor with liquid fuel and continuous reprocessing, Type C in Table 1.

2. A reactor having liquid fuel contained in a "reactor pot" with the coolant in tubes, Type A-1 in Table 1.

3. Coolant outside fuel tubes with liquid or mobile fuel inside tubes, with or without the fast, continuous reprocessing.

Table 1 gives a summary of the significant characteristics of these and the other designs which were considered. The figures given in the table are, at best, reasonable approximations. The design which will be investigated initially is the one which will use a uranium alloy as a fuel in a solid form, Column B, Table 1.

Ultimate Reactor Type . . . The theoretical reactor that would incorporate all the most desirable ultimate objectives is a fast breeder with a true fluid fuel, Type C in Table 1. It would include metallurgical processing and would not have conventional heat-transfer surfaces. It might be built of refractory materials that would be reasonably good for either thermal or high-energy neutrons.

The core of the reactor would be all molten metal.

Fertile material might be either depleted uranium or thorium, depending on the product desired. One primary consideration would be safety. For example, on board a ship or in a congested area, thorium, U-233, and U-235 would probably be used. This, with frequent purification of the fuel metal, would keep the toxic and radiation hazards to a minimum within the reactor and any one storage well. Where adequate protection is provided, a depleted or natural uranium breeder blanket would be used on the outside of the fast reactor core to produce plutonium.

Reactor Configurations . . . Another basically simple mobile-fuel reactor type is one in which a pot of molten fuel is cooled by coolant flowing in tubes or metal shells through it. The container-material problem is critical in this case with a material of relatively high thermal conductivity required to contain liquid-metal fuel at high temperatures.

Types A-1, A-2, and A-3 in Table 1 are variations of this basic idea and are calculated for varying potential fuel compositions and fuel-element dimensions.

To alleviate the materials requirement somewhat, it should be possible to flow fuel in and out of the pot in the molten state but hold it in the solid state at a somewhat lower temperature during the major portion of the time in the reactor. This is the possibility that is envisioned in Type B.

Allowable Investment . . . An appraisal was made of the effect of replacing conventional steam generators with nuclear reactors. The purpose of the study was to determine: (1) The percentage of a power plant and system investment that would be affected if boilers and associated equipment became obsolete, (2) the cost per million Btu at the turbine throttle of present steam plants, and (3) the justified investment in a nuclear reactor and appurtenances, assuming various fuel costs.

The appraisal was based on the power-plant design and estimated economics data for the Detroit Edison St. Clair plant now under construction. This study indicates that for a modern 625-Mw, nameplate, steam power plant costing $98,700,000 about 50%, or $48,293,000 of the investment is in steam generation, ie, land, buildings, and equipment. This amounts to an investment of $73 per kw, based on turbogenerator maximum capability. The turbogenerators have a nameplate capacity of 125,000 kw, with a maximum capability of 156,250 kw. Boiler-plant investment, in turn, represents approximately 17% of the investment in all electrical and distribution equipment of the system. Based on total property investment, which includes office and warehouse facilities, the boiler-plant investment represents about 16% of the total. These data are all based on turbogenerator maximum capabilities.

Therefore, even if a nuclear reactor can be designed, built, and operated at a cost competitive with that of a boiler steam-generating plant, only a relatively small percentage of the total system investment would be affected. Thus boiler steam-generating plants now in operation would not become obsolete to the extent of requiring immediate replacement with nuclear reactors as is sometimes believed.

A nuclear reactor must be able to supply steam to the turbine throttle for a total cost of less than 59.4¢ per million Btu to be competitive with present modern boiler generation. This cost is based on coal at about $7.20/ton, with a heating value of 11,800 Btu/lb, and an annual plant factor of 70%. Assuming no cost for fuel, labor, materials, and supplies, an investment of about $235 per kilowatt of capability could be justified in a nuclear reactor if its design is certain to be economically sound for about 20 years. These costs and high obsolescence do exist, however, and as they become larger, the justified investment for a nuclear reactor is correspondingly decreased.

On the other hand, if products of value other than power can be produced, it may be possible to balance those costs as well as any capital costs above this figure.

Union Electric-Monsanto Chemical Team Reports

Progress on Nuclear Power Plans

Progress information available on Union Electric-Monsanto Chemical research to determine feasibility of a plant for the production of plutonium and electric power includes that portion of the team's report which was recently declassified by the Atomic Energy Commission plus data accumulated since.

The declassified AEC report covers studies on two sodium-cooled, graphite-moderated plants. They would use enriched fuel, U-238. The first plant, Case A in Tables 1 and 2, would have two generating units and a total capacity of 210,000 kw. The second, Case B, contemplated five generating units and a net capacity of 554,000 kw.

One of the major problems in the economic picture of power from the atom, as visualized by this and other study teams, is that of safety. One conclusion which the Union Electric-Monsanto team has reached is that if a reactor cannot be developed which will be ever safe, i.e., would never allow fission products to escape, permitting a plant site approximately the size of an equivalent modern steam plant, it is doubtful whether private industry could ever tackle the ownership and operation of a reactor.

Third Plant Visualized . . . Latest thinking visualizes a third plant also sodium-cooled, graphite-moderated but with a net generating capacity of only 125,000 kw. This would probably be the smallest plant that could be economically developed and would therefore require minimum capital investment. Experience with it would be valuable in any future plant designing.

Such a plant would be built at an estimated cost of $60 million. Incremental cost per kw would be $130. Complete plant cost per kw would be $480. Power generation would cost an estimated 6.05 mills per kwhr if financing costs and income taxes are only 10%. Time from authorization to first operation of the full scale plant would be about four years.

Government support of the plan would be expected to the extent of: AEC assistance in design until a firm decision to proceed can be made, research assistance in AEC laboratories, and a 5 to 10-year government contract to purchase plutonium at a competitive price.

Prior to construction of this 125,000 kw plant a mock up would be built with graphite as a moderator and with perhaps 1 to 2% as many fuel elements as in a regular plant design. This "mock up" plant would not be made radioactive. It would be used to gain design and operating information. This "mock up" program, involving design, construction and operation would cost an estimated $3 million.

The 125,000 kw plant, Case C, would have a reactor in the shape of an octagonal prism 18 ft high and 19 ft across the face. Fuel elements would be tubular uranium metal with sodium flowing inside and outside the element. They would be arranged vertically on a square lattice. The loaded reactor would require about 70,000 kg of uranium with a U-235 concentration of 1.5 to 2.0%.

A primary and secondary sodium cooling system would be provided. Radioactive sodium from the reactor would release its heat to non-radioactive sodium in the secondary system outside the shield through four shell and tube heat exchangers. Non-radioactive sodium would release its heat to water in the steam generation circuit and then in a dump heat circuit. The ten sodium-to-water heat exchangers would have a mercury filled barrier space similar to that for Case B. Steam would be generated at 600 psia with a cycle efficiency of about 30%. Net power output would be 125,000 kw at 1.5 in. Hg.

When plutonium is no longer needed, no heat would be dumped; and the reactor cooling temperature would be raised. This would mean a lowering of the reactor heat output, but adequate high pressure and high temperature could be generated to operate the power plant at high efficiency.

Cases A and B from Declassified Report . . . Cases A and B covered in the declassified AEC report have the same general characteristics, summarized in Table 1. They differ in the coolant system and also in fuel loading and unloading techniques.

Economics developed on these cases was based on reactor operation for the production of military plutonium and electric power for five years and electric power alone when there is no longer a market for military plutonium. All plant costs are amortized in this five years.

The factors considered included: Operating safety, both mechanical and nuclear; the loading and unloading of fuel elements, including short slug and long continuous

Scientists Must Learn More About . . .

Smaller, but still safe, exclusion areas.
Effects of radiation on essential components and assemblies of them.
Reaction between sodium and graphite under temperature, stress, and other conditions.
Possible graphite temperatures and their effects.
Possible carburization and embrittlement of the thin cooling channel tubes.
Feasibility of constructing fuel assemblies.
Corrosion and erosion of fuel element jackets by sodium under in-pile conditions.
Radiation damage to materials of construction, components, and mechanisms.
Development of mechanisms for refueling and retubing the reactor at operating temperature and in the presence of sodium in the vapor or light liquid state.
Refueling techniques and the effect upon reactor control of unloading and refueling during operation.
Effect of sodium on construction materials and on platings for uranium.
Durability of plating on uranium under operating conditions.
Decontamination and repair or replacement of components in the reactor and heat exchange system.
Development of suitable sodium pumps.
Design of containers for shipment of fuel elements to the chemical processing plant.
Monitoring and purifying the circulating helium gas.
Design and construction of a reactor simulator for study of the complex time and temperature relations.
Design limits for the heat output of any fuel channel to establish a suitable factor of safety.

cartridges; continuity of operation; the possibility of making internal repairs; and the problem of reliability of the unit.

Reactor Types Studied . . . Reactors studied included:

1. Sodium-cooled, graphite-moderated with metallic-uranium fuel elements.
2. Sodium cooled, heavy-water-moderated with metallic uranium fuel elements.
3. Light-water-cooled, light-water-moderated with metallic uranium fuel elements.
4. Aqueous homogeneous.
5. Special types.

Sodium-Cooled, Graphite-Moderated . . . When these studies were begun, plans called for early design and construction. The Hanford reactors were chosen for initial study. They offered large power output, several years of actual operating experience, data on capital and operating costs, and many nuclear constants and other physical data.

These reactors required a high-temperature coolant. Pure sodium was chosen because of the possibility of severe interaction between potassium and graphite and because of the higher absorbtion factor of the sodium potassium eutectic.

Study indicated that the very high film heat-transfer co-efficient, the greater permissible temperature rise of the coolant without involving pressure, and the lack of corrosion of stainless steel by sodium up to temperatures of at least 900F would make it possible to remove larger amounts of heat from the fuel elements with sodium than could be removed with water, whether pressurized or not.

The temperatures which maximize plutonium production are high enough to permit the practical generation of electrical power. This does not appear to be the case with water as the coolant.

After weighing the relative merits of this and other types of reactors, it was felt that the sodium-cooled graphite-moderated reactor is one of the most promising ones that might be build in the immediate future to augment the plutonium supply. However, our investigations included brief studies of other systems, some of which showed promise as possible, but later, competitors of the sodium-cooled, graphite-moderated type of power reactor.

Reactor A . . . Metallic uranium was chosen for the fuel in the first reactor design, and 1,100F was selected as maximum uranium temperature as changes in uranium occur at the transition temperature of 1,229F. In one case internal cooling of the fuel element was chosen and in the other a combination of internal and external cooling was selected because that offered advantages over either method alone.

Design calls for the moderator and surrounding two-foot thick reflector to be assembled from graphite blocks to form an octagonal prism 24 ft high and 39 ft across the face. Tubular fuel elements would be placed in cooling channel holes spaced on a square lattice in the prism. Fuel elements would be cooled by sodium flowing through them and the annular space between the walls of the cooling channel and the fuel elements.

The hot sodium would flow through a heat exchanger and be pumped back to the reactor. Special measures would be provided to prevent the sodium vapor from diffusing into the graphite, to detect sodium leaks, and to cool the graphite.

Table I.—Characteristics of Monsanto-Union Electric Sodium-Cooled Graphite Reactor Designs

Data	Case A	Case B	Case C
Neutron Energy	**Thermal**	**Thermal**	**Thermal**
Power:			
Heat, megawatts	**1,000**	**3,000**	**675**
Materials and amounts:			
Percent enrichment of U^{235}	0.83	0.95	0.95
Amount of uranium, kg	214,000	214,000	70,000
Fuel elements	Internally cooled tubes	Internally and externally cooled tubes	Internally and externally cooled tubes
Moderator	Graphite	Graphite	Graphite
Reflector	Graphite	Graphite	Graphite
Shield	Concrete	Concrete	Concrete and iron
Primary Coolant	Na	Na	Na
Fertile Material	U^{238}	U^{238}	U^{238}
Fuel:			
Max uranium temp, Deg F	1,100	1,100	1,100
Coolant:			
Inlet temperature, Deg F	300	300	300
Outlet temperature, Deg F	650	900	825
Maximum velocity, ft/sec	20	20	20
Gal/min at 300F	70,000	120,000	32,000
Cfm at 300F	9,000	16,000	4,000
Pumping power, kw	3,000	5,000	3,000
Dimensions:			
Core	Octagonal prism, 20 ft high and 35 ft across flats	Octagonal prism, 20 ft high and 35 ft across flats	Octagonal prism, 15 ft high and 16 ft across flats
Reflector thickness, inches	24	24	20
Shield thickness			8 ft

Nuclear Characteristics . . . Studies indicate that the most economical plutonium-power reactor is one using enriched fuel. The cost of enriching is more than offset by the reduced unit cost of the plutonium produced because enrichment gives a higher allowable specific power, a longer permissible irradiation of the fuel, and higher plutonium concentration in the output uranium.

Fuel elements, suitably encased, would be maintained in a central position in the cooling channel by special positioning devices. Fuel channels can be loaded and unloaded by remote control while operating at full load. Irradiated fuel assemblies removed from the reactor would be stored for several days in an extension to the reactor for cooling preparatory to shipment to the chemical processing plant.

Heat Exchangers and Sodium Handling . . . Electricity is to be produced from the heat generated in the reactor by means of a conventional steam power plant.

To prevent contact, and the resulting violent reaction, between

Table 2.—Electric Power Costs

	Case A		Case B		Modern coal-fired plant		Case C	Modern coal-fired plant
Capital cost, $ million	26		61		44		16(c)	22
Net output, kw	210,000		554,000		260,000		125,000	125,000
Cost, dollars/kw	124		110		169		130(a)	175
	$ per yr (millions)	Mills/ kwhr	$ per yr (millions)	Mills/ kwhr	$ per yr (millions)	Mills/ kwhr	Mills/ kwhr	Mills/ kwhr
Depreciation(b)	5.20	3.30	12.20	2.94	1.26	0.65	3.47	0.68
Property taxes and insurance	0.52	0.33	1.22	0.29	0.88	0.45	0.35	0.47
Coal, $0.23 per million Btu	0.0	0.0	0.0	0.0	4.63	2.37	0.00	2.37
Operating cost	0.79	0.50	2.10	0.50	0.98	0.50	0.50	0.50
Total	**6.51**	**4.13**	**15.54**	**3.73**	**7.75**	**3.97**	**4.32(d)**	**4.02(d)**

(a)Assumptions: Plutonium sale offsets all fuel costs, operating time, 7,500 hr/yr; taxes and insurance, 2% and depreciation, 20%.
(b)Twenty percent on case A, B, and C, 2.86% for coal-burning plants.
(c)Reactor plus power plant is estimated at $60 million. For plutonium production only, the total plant would cost about $16 million less.
(d)In normal utility practice, additional cost of financing plus income taxes would be about 10%, thus increasing total cost of power to about 6.33 mills/kwhr. If additional costs for Case C are only 10%, the total power cost would be 6.05 mills/kwhr.

sodium and water, the heat exchanger will be a shell-and-tube type with double concentric tubes to provide a barrier space between the two mediums. The barrier or leakage space will be filled with mercury to give good heat transfer and will be provided with a leak-detection system to warn of a tube failure on either the sodium or water side of the exchanger.

Safety hazards of sodium leaks and the radioactivity of the sodium in the recirculating system require the entire sodium circuit to be completely leaktight. Normal type glands or packings were not acceptable and a double bellows type of seal for valve stems was developed. This seal has a leak detector between the two bellows to indicate failure of either.

Internal Cooling—Case A . . . The power cycle for the first plant design, Case A, is based on receiving sodium from the reactor at 650F and returning it at 300F. Hot sodium from the reactor will flow through heat exchangers to produce turbine throttle steam at 150 psia dry and saturated. Steam will be generated at a rate of 3 million lb/hr and fed to a turbine cycle with a gross thermal efficiency of approximately 22%. Resulting electrical output will be about 220,000 kw from two turbogenerator units of 110,000 kw each. Auxiliary power for pumping cooling water, condensate, and sodium totals approximately 5.5% of the gross capability.

Such turbo-generator would require four 18-in. steam inlets and employ a live-steam reheat between stages. Regenerative feed-water heating would not be used. Condensate would be returned to the exchangers as cold as possible so as to take advantage of the low sodium inlet temperature and obtain the lowest capital cost per kilowatt, even at a slight decrease in cycle efficiency.

Internal and External Cooling—Case B . . . Two power cycles have been considered for the Case B reactor, one utilizing the heat output of the sodium coolant over the entire temperature range between the reactor inlet and outlet temperature, 300 to 900F, the other rejecting the heat of the coolant below 500F directly to the heat sink.

Main advantages of the latter cycle are a substantially reduced total investment and a power output of more readily marketable size.

Steam conditions for both power cycles have been taken as 400 psia, at 746F to the turbine and 1.5 in. Hg absolute pressure at the condenser. In the first cycle, steam would be generated at a rate of approximately 8.8 million lb/hr and would be fed to a turbine cycle with a gross thermal efficiency of approximately 28%. The gross electrical output would be about 878,000 kw from five turbo-generator units. Auxiliary power, including the pumping of sodium, will amount to approximately 5% of the gross capability.

In the second cycle, steam will be generated at the rate of approximately 4.8 million lb/hr with the same cycle efficiency. Gross electrical output will be about 579,000 kw from three turbo-generator units. Allowing for auxiliary power and sodium pumping, the net output will be about 554,000 kw. The heat from the coolant in the temperature range of 300 to 500F will be rejected by producing steam at 25 psia and condensing it at 20 psia in a water-cooled heat exchanger.

Power Without Plutonium . . . At the end of the five year period during which both plutonium and power would be produced, assuming that sufficient nuclear fuel would continue to be available, there would be several possible courses.

First would be continued operation of the reactor as a heat source for the production of steam generated electricity. Although it would no longer be necessary to refuel as often and even though operating costs would be reduced somewhat, the cost of electricity might still be about as high as that generated from the conventional fuel burning plants, even though the equipment were fully amortized.

From the national viewpoint, a reactor in continuous operation would be immediately available as a producer of plutonium. The value of having a standby plant in operating condition should be credited to reactor operation and this should result in substantial reduction in power cost.

Costs of producing electrical power for Designs A, B and C are compared with those for a modern coal-fired plant in Table 2. Capital costs figures do not include: Cost of land, financing charges, public liability insurance, federal income taxes, and profits.

STUDY OF PHOTOS is made by G. L. England, left, R. S. Ewers, and J. E. Strong for preliminary selection of route to be surveyed by aerial method

ELEVATIONS AND CLEARANCES at this location are typical of those easily established

Aerial Surveys for Line Routes Save Time and Money

Any type of terrain can be surveyed far more quickly at savings up to 50%. Job can be done secretly and jacked-up prices for rights-of-way avoided

Aerial surveys of contemplated routes for transmission lines are saving survey time and money for the Illinois Power Co. The company began using the method in 1945 when it launched a program of plant construction. An aerial survey was made to pick the route for the first 138-kv line connecting the new plants with load centers. Since then the method has been used for 500 of the 700 miles of line built.

The success of the aerial survey is attributed by transmission engineer, G. L. England to the following:

1. Land owners are not irritated in advance of construction by land survey crews. An aerial survey can be made and tower locations chosen without property owners being disturbed. This facilitates the purchase of the right-of-way easements and avoids occasional land speculation.

2. By comparison with ground survey crews working under conditions of restricted visibility, the most desirable route can be selected with greater ease and assurance that it is the best one. The line can be extended for greater distances along tangent sections, and sharp angles requiring objectional guying can be eliminated. This was particularly important as H-frame towers were used almost exclusively.

3. Aerial surveys conserve the time of draftsmen and ground survey crews and do not divert them from the actual design and layout of portions of the power line approved for construction. In addition management saves time because it can get data faster from the photographs which can be secured in a few weeks.

4. A photographic record of the entire route is provided at no additional expense.

5. Aerial surveys cost only $175 to $200 per mile. Length of line and the nature of the terrain are the principal factors involved. Land surveying

CAMERA MOUNTING used in the surveys made for Illinois Power Co. The modified aircraft also has an extra fuel tank and special navigation instruments

usually costs from 50 to 100% more and takes longer.

Preparation for Aerial Survey . . . The area of possible line routes is selected by referring to:

1. Topographical maps (U.S. Geological Survey)
2. County maps on a 1 in. to-the-mile scale
3. Aerial photographs from the Department of Agriculture, to a scale of 1 in. to 100 ft.

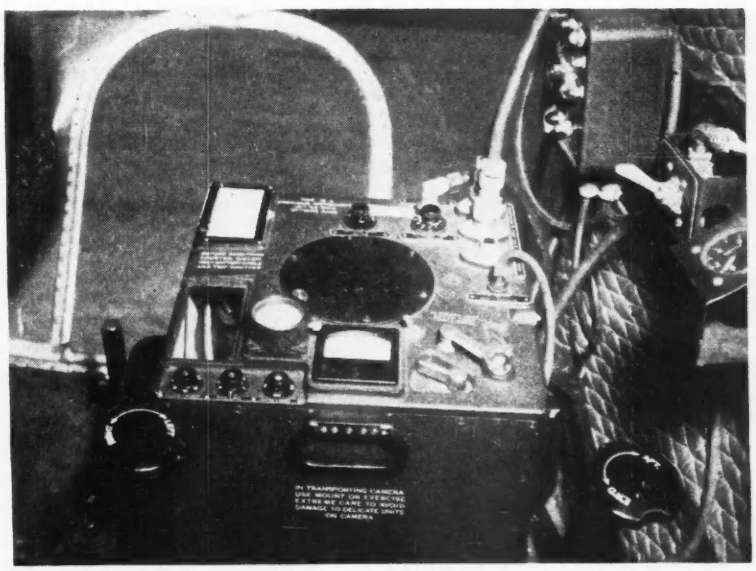
Transmission line terminal points are indicated on these maps. Possible routings are studied, and two or three are developed. The preferable route is selected, and a field trip made by auto to find out if there are any obvious objections. Sometimes, the auto trip is supplemented by a plane flight over the route. The objective in the selection of a route is to choose one, of minimum length, that approaches a straight line as closely as possible. Proper consideration must be given to accessibility, overall construction costs, and future operation and maintenance requirements.

Aerial Survey Takes Over . . . Information developed up to this point is given to an aerial survey firm which has proved its ability to produce a survey having an accuracy within 1% on the horizontal scale and approximately 1 ft on a vertical scale. Actual survey flights require a clear day and a plane specially adapted and equipped for the job. Long distances over wooded country must be covered when the leaves are off the trees. A precision mapping camera is used. Flights are held to an altitude of 2,500 ft, and a series of exposures is made with 60% overlap.

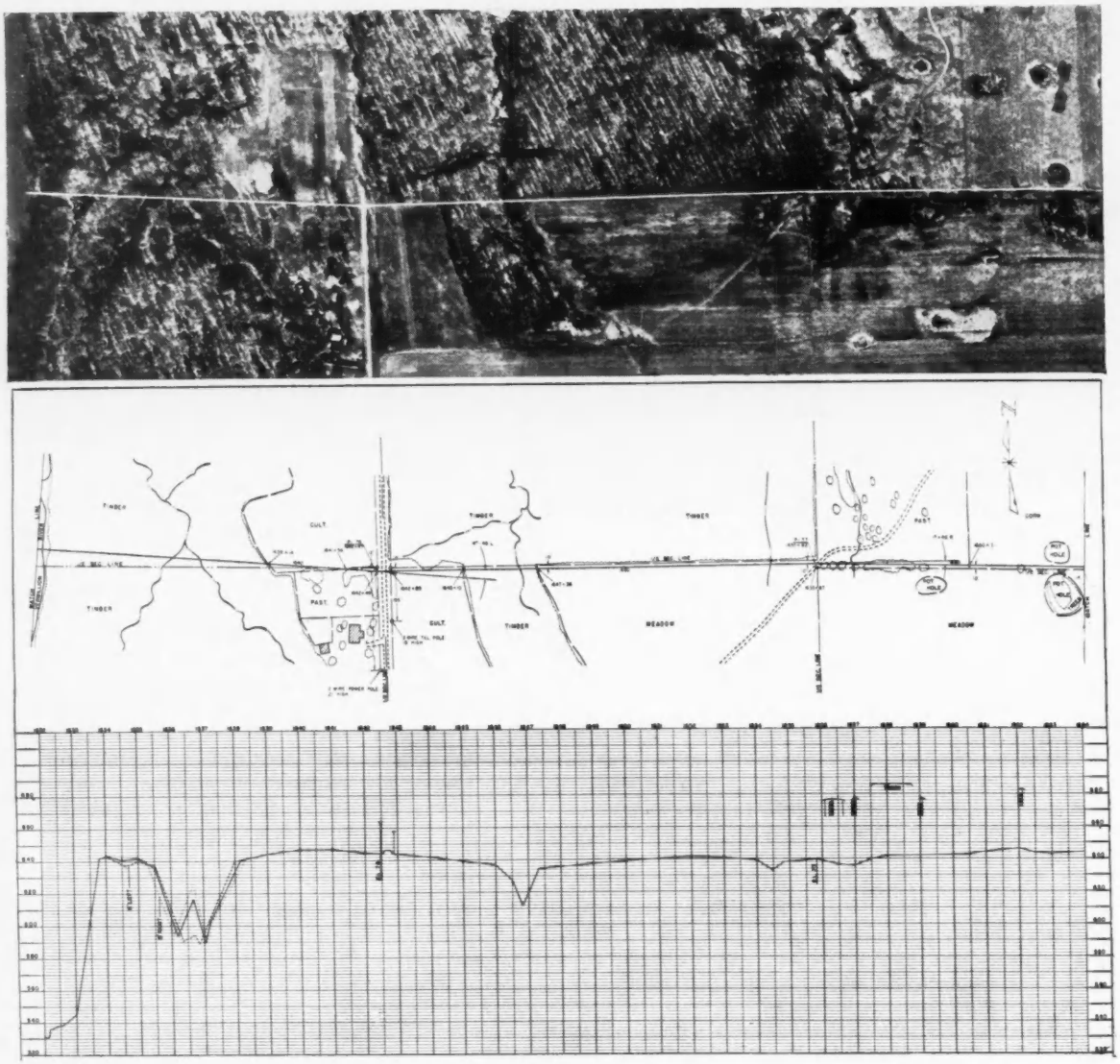
Contact prints of these exposures are taken to the field, and control measurements from identifiable landmarks are made with a tape. These measurements serve as guides which are used only by the aerial survey firm to enlarge the photos to a precise scale of 1 in. to 100 ft. Elevations of objects on these enlargements can be determined to an accuracy within 1 ft. Heights of bushes, trees, buildings, and pole lines can be indicated thereon. Even stock in the pastures and wheat shocks in the field can be picked out.

The survey firm can therefore prepare accurate plan and profile drawings, showing the centerline and elevations at the centerline of the route. Also all physical features within 300 ft on each side of the centerline are plotted.

Company Gets All Information . . . Complete sets of contact prints and tracings of the plan and profile draw-



AERIAL MAPPING CAMERA with the Abrams Intervalometer (top right above camera), which assures split second timing of exposures. *(Photo: Abrams Aerial Survey Corp)*



ACTUAL PHOTO AND PLANIMETRIC MAP and elevation profile prepared by the aerial survey service. Photo covers a 500 to 600-ft wide survey strip and is shot from 2,500-ft altitude. Elevations shown by the graph are at centerline of route shown on photo and map

ings are then sent to Illinois Power. Company engineers lay out the line, spotting structures along the route. Final design of the transmission line is achieved with this information. To this point, it has not been necessary to contact property owners or even trespass on their property.

All of the route information is assembled, the easements for property rights are written, and right-of-way negotiations are consummated without the general public having previously known that a power line is planned for their area of interest. Unnecessary advance irritation of land owners has been avoided. Draftsmen and ground survey crews have been conserved for the actual design and construction layout of established sections of the line. Substantial advancement of time schedules has been achieved by these features of the aerial survey procedure.

Additional cost reductions have been realized because transmission line contractors themselves have studied the aerial photos to spot timber and other obstacles which would affect their bids. Because the height and extent of timber are known, clearing and trimming can be accurately determined. The elimination of these and other uncertainties of bidding has been reflected in savings to the company.

Plane Equipment . . . The Abrams Aerial Survey Corp, which has been making the surveys for the company, has been using a fleet of Beechcraft AT-11's. Each plane is equipped with extra fuel tanks, special camera mounts, precision timing and automatic controlling devices, and special navigation instruments. Each carries also a Fairchild camera and an Abrams Intervalometer. This instrument assures split-second accuracy in making exposures as the plane is flown over the survey route.

WASHINGTON COMMENT

JESSE MOCK

TVA Gets Gentle Spanking from the GOP

Although a brainchild of the late Republican Senator, George Norris of Nebraska, Tennessee Valley Authority was born and reared as a favored relative of the New Deal and Fair Deal. With little ceremony it marked its twentieth anniversary last month. Soon thereafter it learned some of the facts of life from a new administration that is not given to pampering its agencies.

On the very same day:

President Eisenhower referred to TVA as one of the signs of the "creeping socialism" fostered by the Democrats. He went on to say that some re-evaluation of the agency is needed.

The House voted against any increases above the $188 million TVA budget submitted by the new administration.

While these setbacks did send TVA supporters away whimpering, there was no immediate sign that they amounted to much more than a verbal spanking. Once out of sight, the TVA fellows probably gave a sigh of relief that it was no worse. They still had some talking points.

In the same statement in which he had branded the agency as a bad example, the President reiterated he is not out to destroy it. He called it an experiment, and indicated it would not be tried elsewhere without considerable alteration. Even for the Democrats, TVA had remained a unique experiment.

TVA Did Get $178 Million for Power . . . Nor was the economy-minded House of Representatives acting particularly vindictive toward the agency. On the contrary, it was voting every cent the administration has requested for TVA power facilities—some $178 million of the total $188 million TVA budget. Funds voted for power facilities were $61 million less than had been asked by the former Truman administration.

This cutback would mean that the new Fulton 500,000-kw steam plant which TVA planned to start just north of Memphis is out the window for the time being. It would also mean a slowdown on other generating and transmission construction, but the slash is less proportionally than has been made in budgets of other agencies.

Asked by a Republican critic whether TVA has been treated fairly or not, a TVA-area House member replied:

"I think you gave it better treatment than I would ordinarily expect from a Republican Congress. I will say that. I am being honest about it."

TVA Officials Went Down Fighting . . . While TVA took its spanking, it didn't pass up the chance to educate its guardian on a few points. A Truman-appointed board of directors still runs the agency, and they and other TVA friends fought a pitched battle up to the final votes.

At subcommittee hearings that preceded the House action on TVA funds, a parade of witnesses including the governor of Tennessee and several rural cooperative representatives limbered up their best oratory on behalf of the Authority. There were letters from the governors of Alabama and Kentucky endorsing the strong presentation made by some of these proponents. Numerous letters from other sources advocating increased funds poured into Congressional offices.

Once on the House floor, the TVA-area Congressmen swung into action. Although the same bill carried funds for such important agencies as the Atomic Energy Commission and the Veterans Administration, the TVA funds drew far the most debate.

Some idea of the effect which this effort had can be gathered from a comparison of two of the standing votes.

By a vote of 154 to 83 the House voted not to increase the Funds Bill by $30 million to permit a start of construction on the Fulton Plant.

But by an even larger majority—153 to 69—the House voted against a proposed $17.8-million decrease in TVA funds.

It appeared to boil down to this: House Republicans were willing to take a chance on the cuts approved by the Eisenhower administration, but they weren't willing to go any further. This is a reluctance they have seldom displayed either this year or in recent years.

TECHNICAL NOTES

ARCHER E. KNOWLTON

More transformer noise closer to more people is a likely concomitant as load densities increase and substations multiply.

Shaft-driven exciter advantages are in part at least offset by the undesirable necessity of whole-unit shutdown for maintenance of the commutator—much less dependable than the generator.

Coal constitutes 98% of our combustible fuel resources; petroleum and natural gas less than 2%. Coal is being used for 45% of our energy requirements; oil and gas for better than 50%.

Alarm indicators should not be too far from the center of the operating board.

Concrete in dam-face repairs should not be vibrated or tamped until at least one-half hour after pouring so as to allow time for initial set shrinkage.

Foam rubber makes good protective packing when delicate instruments are to be shipped.

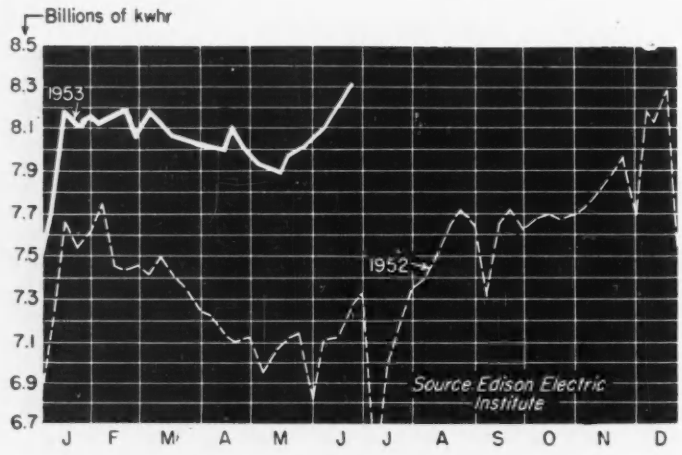
Shaft-driven generator-exciter voltage may lag considerably during the starting of boiler feed-pumps and large induced-draft fans.

Gauge glasses are not considered as accurate a measure of drum water level as the boiler control instruments. Maybe they are getting to be a vestigial relic of the lower pressure era.

Electronic engineers might help win a war by being assigned as supply depot sergeants or ship's cooks but why gamble when freedom is at stake?

Under-excited synchronous condensers can ordinarily absorb about half as many kilovars as they can produce. Each kilovar thus neutralized at light load is worth the difference in cost between switched and unswitched capacitors.

STATISTICS



Output Week Ended June 20—8,329,297,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
June 20	+14.8	+15.1	+9.2	+20.6	+16.0	+18.7	+16.7	+7.7	+10.9	+7.4
June 13	+15.7	+15.3	+12.5	+21.0	+15.2	+19.1	+18.9	+6.1	+13.0	+5.6
June 6	+15.6	+12.4	+10.4	+19.3	+14.5	+19.5	+24.6	+10.2	+17.7	+4.4

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Apr.	72.9	73.5	65.4
Capacity (Million Kw)	Apr.	83.84	83.17	76.74
Production (Billion Kwhr)	Apr.	35.63	36.97	31.51
Hydro		9.70	10.20	9.96
Fuel		25.92	26.77	21.55
Fuel Consumption				
Coal (Million Tons)	Apr.	8.91	9.44	8.05
Oil (Million Barrels)		7.15	8.08	4.20
Gas (Billion Cu Ft)		76.58	70.16	66.50
Sales (Billion Kwhr)	Apr.	31.75	31.73	28.33
Residential		8.86	9.10	7.91
Commercial		5.15	5.18	4.74
Industrial		15.46	15.36	13.85
Other		2.28	2.09	1.83
Net Income Class A & B Companies ($ Million)	Mar.	90.61	98.39	84.32
Estimated Dec. '53 Peak (Million Kw)	Mar.	86.5	86.5	88.6
Kwhr per Residential Customer (12 Month Average)	Feb.	2,195	2,183	2,037
Revenue per Kwhr Residential Service (12 Month Average)	Feb.	2.76c	2.77c	2.80c
Canadian Production (Billion Kwhr)	Mar.	5.78	5.26	5.22

Business Statistics

FRB Industrial Production Index†††	May	242*	240*	211
Gross National Product Annual Rate ($ Billion)	4th Qtr.	355.2*	343.0	337.1
E. W. 5 Industry Production Index	Apr.	131.1	130.8	118.8
ENR Construction Cost Index††	June	124.4	123.5	117.8
BLS Consumer's Price Index	Mar.	113.6	113.4	112.4
NEMA Insulation Materials Sales Index†	Apr.	694	694	545
NEMA Electric Appliance Sales Index†		317	356	211
NEMA Household Refrig. Sales Index†		188	211	133
Metal Prices (June 23)				
Copper, Conn. V., lb		$ .29¾-.30	$ .29¾	$ .24½
Lead, N. Y., lb		.13½	.13	.16
Zinc, prime Western E. St. Louis, lb		.11	.11	.15
Tin, Straits, qual. N. Y., lb		.93½	.97¼	1.21½
Aluminum, ingot, base price		.20½	.20½	.19
Nickel, base price		.60	.60	.56½
Steel, billets, Pitts., ton		59.00	59.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		39.00	45.00	45.00

*Preliminary **Revised †1936=100 ††1949=100 †††Unadjusted

Plant and Equipment Expenditures for 1953

Business is planning to continue its high rate of expenditures on new plant and equipment through the third quarter of 1953, according to a survey of capital outlays conducted jointly by the Securities and Exchange Commission and the Department of Commerce during May. The survey indicates that capital outlays of $7.2 billion and $7.1 billion are scheduled for the second and third quarters of this year.

If present programs materialize, plant and equipment expenditures for the first nine months of this year will total $20.5 billion, 7% higher than the corresponding period of 1952. If this rate of investment is achieved, it appears likely that the previous estimate of $27 billion for 1953 will be exceeded.

Plant & Equipment Expenditures
Millions of Dollars

	First nine months 1952	First nine months 1953	% change
Manufacturing	8,626	9,226	7
Durable goods industries	4,130	4,291	4
Non-durable goods industries	4,497	4,934	4
Mining	651	649	—
Railroads	1,035	1,051	2
Transportation other than rail	1,030	1,007	2
Public utilities	2,696	3,325	23
Commercial and other	5,155	5,221	1
Total	**19,193**	**20,479**	**7**

The survey indicates that public utilities are expecting the largest increases in capital outlays over last year. About $3.3 billion of expenditures have been scheduled for the first nine months of 1953, or about one fifth more than in the same period last year. Manufacturers expect a 7% increase with a larger increase for non-durable goods industries than for durable. Railroads indicate a slight increase between the two nine-month periods while a small decline is expected by non-rail transportation.

Plant and equipment expenditures are expected to reach new records in the second and third quarters of this year. On a seasonally adjusted basis the scheduled outlays indicate annual rates of $28.4 billion in the second quarter and $28.7 billion in the third quarter of 1953.

FINANCIAL

Illinois Goes 'Fair Value' . . .

. . . as a result of a rate base decision of Illinois Commerce Commission involving Peoples Gas Light & Coke Co

Illinois, always considered an "original cost" state, has joined the ranks of "fair value" jurisdictions. This is evident from the recent decision of the Illinois Commerce Commission in the Peoples Gas Light & Coke Co (Chicago) rate case.

Illinois Bell Leads Way . . . Early this year, the State Supreme Court, ruling on an appeal of the Illinois Bell Co in a rate case, delivered a strongly worded opinion wherein it made amply clear that Illinois was a "fair value" state. The court said that rates were to be predicated upon the "present fair value of the utility property" and that in order to ascertain such fair value, the commission was required to "take into account current economic conditions, price levels and reproduction cost" as well as "the original cost of construction, the amount expended in permanent improvements and the probable earning capacity of the property under the particular rates prescribed."

This ruling became a precedent when Peoples Gas sought a rate increase. In determining the rate base, the ICC considered both "original cost" and "reproduction cost new." While it stated that it rarely accepted spot-date prices, which in this instance amounted to $343,423,000, it found that the "reproduction cost new" of the depreciable used and useful property at $337,909,000 was equivalent to the 15 months average price level as of Dec. 31, 1952.

This comparatively high average price level is unusual for most "fair value" jurisdictions in that it is much closer to the spot-date than to the 39-month average of $322,223,000.

Fair Value Established . . . The net original cost of the property less depreciation was found to be $143 million while the "reproduction cost new," less observed depreciation, amounted to $266 million. On the basis of these two figures the commission established the "fair value" of the property at $200 million. This is some 29% higher than the "original cost" and is considered a realistic appraisal of the inflationary period under which the utilities are currently operating. It also demonstrates commission's adherence to the spirit of the "fair value" doctrine as prescribed by the Supreme Court.

It is interesting to note that the commission also allowed construction work in progress on which no interest was charged as part of the fair value of the used and useful property of the company. The advantage of this method lies in the fact that the full rate of return will apply to construction work in progress rather than some lower interest rate which is generally allowed in charging this item.

As regards the calculation of working capital, it appears that the commission deducted federal income tax accruals in arriving at the allowable amount. To this extent, some utility men are unhappy. They believe this ruling follows what they term the erroneous precedent set by the Federal Power Commission and some of the other regulatory jurisdictions.

Economic Depreciation . . . They also are disappointed in the fact that the commission gave no visible weight to economic depreciation to which a considerable volume of testimony was devoted by various witnesses for the company. However, in spite of that, the allowable expense for depreciation was increased from 1.64% to 2.58%. This would appear to be rather a matter of correcting a past deficiency than taking cognizance of economic depreciation. The admission by the commission of testimony on economic depreciation, however, has been welcomed by utilities as a step in the right direction for future rate case presentations.

The rate of return set by the commission amounted to 5.8% on the fair value of the property, or an amount equal to $11.6 million which is equivalent to a rate of return of 7.45% on a "net original cost" rate base including construction work in progress. This is higher than the level of rates usually set for big urban utilities and is indicative, generally, of the changed attitude of both the commission and the court in Illinois.

FINANCIAL BRIEFS

Oregon's Public Utilities Commission Accountant C. G. Hieber has testified that he found "no discrepancies" in steam surcharge cost audits of the books of the five private utility companies involved in the Pacific Northwest customer billings being reviewed in complaint hearing by the Oregon commissioner.

Appalachian Electric Power Co has been granted a new 30-year franchise in the town of Galax, Va. . . . **Elk Horn, Iowa, citizens** have voted 120-to-77 in favor of renewing the Iowa Public Service Co franchise for 25 years . . . **Telluride Power Co** has received a renewal of its 25-year franchise in Salina, Utah.

Federal Court Judge Francis W. Ford, Boston, has approved the sale of developed water power sites and other property of the International Hydro-Electric System in New York State and Maine to the trustees of Dartmouth College, Hanover, N. H., for $9,970,000. Under a lease to the International Paper Co, the properties will yield rentals of $1,175,000 a year, tax free, to Dartmouth. The lease expires in 1962. Judge Ford also approved the sale of other water power properties held by Eastern New York Power Corp, a subsidiary of International, to the Paul Smiths, N. Y., Electric Light, Power & Railroad Co for $350,000.

City of San Antonio, Tex., will ask for bids on $10 million electric and gas systems revenue improvement bonds around July 8 . . . **Ketchikan, Alaska, City Council** has authorized the sale of $1,350,000 utility revenue bonds to Pacific Northwest Co of Seattle at 4.75% interest. Last year the city sold $900,000 of bonds at 3.59% interest rate . . . **Philadelphia Electric Co** will pay Sept. 30 a quarterly common stock dividend of 40¢ a share as compared to 37½¢ pre-

viously . . . **Scranton Electric Co shareowners** have until July 15 to exchange their stock for Pennsylvania Power & Light Co securities.

Josephthal & Co, in its "Monthly Review of Utility Developments," has said that "utility stocks will develop further weakness and that the recent decline is only the start of a major cycle which may be prolonged and end in a period of abnormally high yields of 6½% to 7½% to offset the recently completed period of low yields."

Washington Water Power Co has just prepared an interesting report titled "The PUDs of Washington State" for its employees. The aim of the booklet is not to discuss the theory of private versus public power but to present significant provisions of the PUD law and factual information about its operations. For copy, write Kimball Jack, 825 Trent Ave., Spokane, Wash. . . . **Indianapolis Power & Light Co** is using post-card type bills for its customers . . . **Miamisburg, Ohio, citizens** will vote in November on whether to sell the municipal power plant to Dayton Power & Light Co, the highest bidder . . . **Seaboard Power Corp,** Sydney, N. S., has asked Public Utilities Board of Nova Scotia approval to sell $2.5 million first mortgage bonds . . . **Kentucky Court of Appeals** has affirmed Wayne Circuit Court decision for the city of Monticello and its Electric-Plant Board to acquire the electric plant by condemning existing facilities of the privately owned Monticello Light Co or by constructing a new municipal plant.

In letters to Washington State Public Service Commission and E. M. Weston, president of the Washington State Federation of Labor, Rep Thomas M. Pelly, Republican of Washington, said that he opposed merger of the Washington Water Power Co and Puget Sound Power & Light Co as he believes the merger would not be in the public interest. Sen Henry Jackson, Democrat of Washington, also opposed it as it would "leave the Pacific Northwest power situation in turmoil."

Securities and Exchange Commission has adopted a new and simplified form (S-8) for the registration of securities offered in connection with employees stock purchase plans.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1953									
June 18	**3.37**	**3.54**	**3.68**	**4.53**	**4.70**	**4.90**	**5.53**	**6.08**	**6.20**
June 11	3.36	3.52	3.66	4.51	4.73	4.86	5.46	6.04	6.18
END OF QTR.									
1st 1953	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50
4th 1952	2.99	3.03	3.14	4.06	4.22	4.59	4.98	5.33	5.62
3rd 1952	2.99	3.03	3.16	4.10	4.26	4.61	5.18	5.59	5.96
2nd 1952	2.95	3.00	3.09	4.05	4.31	4.60	5.38	5.85	6.42

Data: Reis & Chandler, Inc.

EARNINGS

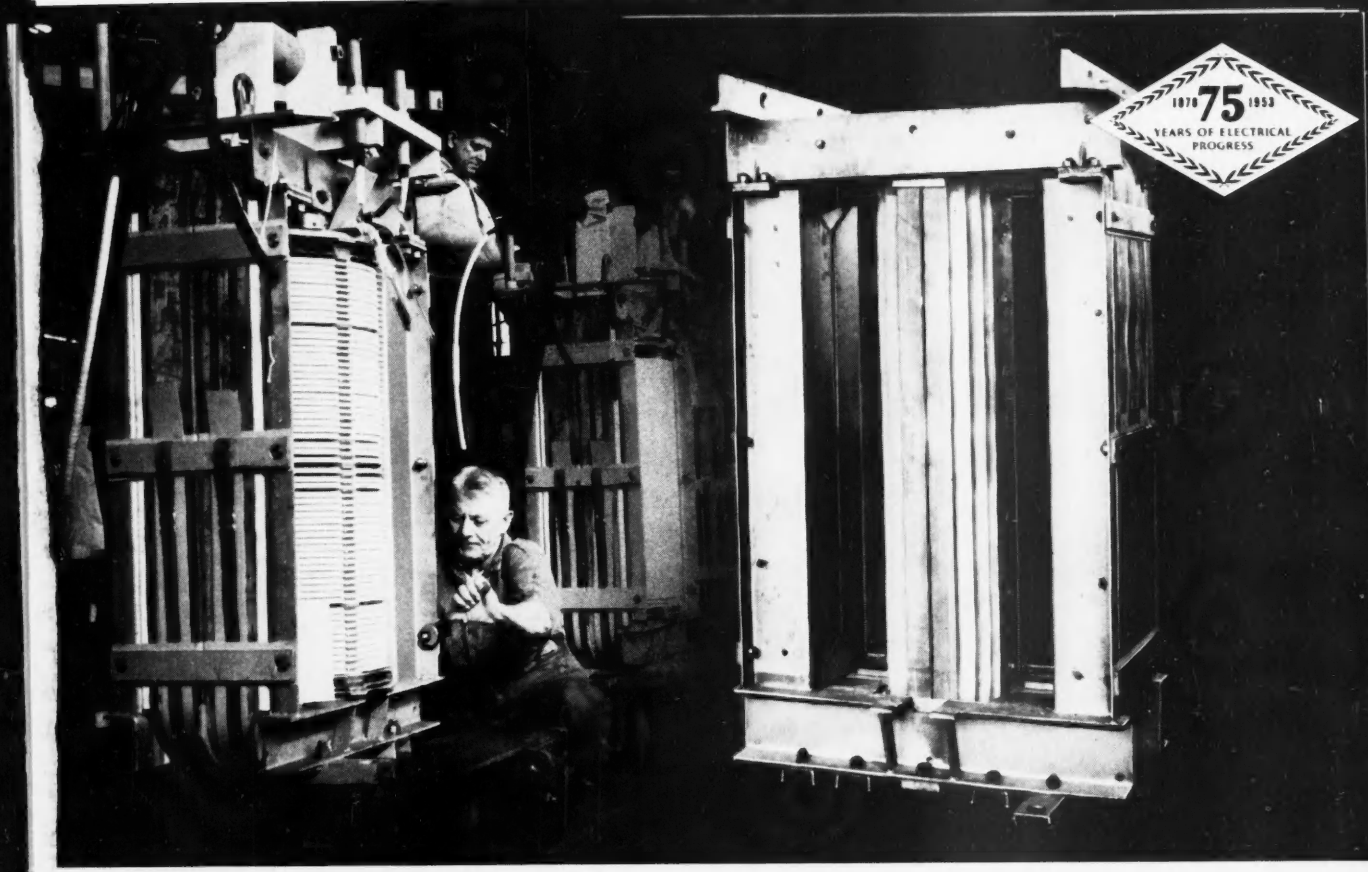
Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Arkansas Power & Light	12	May	$6,426,734	$5,501,690	$....	$....
Carolina Power & Light	12	May	7,139,024	6,550,583	....	....
Central Illinois Light	12	May	3,378,250	3,057,709	....	....
Detroit Edison	12	May	19,893,426	15,624,495	1.90(c)	1.63(c)
Louisiana Power & Light	12	May	3,324,566	2,634,817	....	....
Mississippi Power & Light	12	May	3,683,602	3,143,284	....	....
New York State Electric & Gas	12	May	7,991,346	7,158,689	2.53	2.26
Ohio Edison, consolidated	12	May	17,602,428	14,682,839	2.89(a)	2.74(a)
Pennsylvania Power	12	May	2,253,685	1,974,506	....	....
Southern Indiana Gas & Electric	12	May	2,015,925	1,750,230	2.01(b)	1.95(b)
			1952	**1951**	**1952**	**1951**
City of Winnipeg Hydro Electric System	12	Dec.	$17,215	$4,419(d)	$...	$....

Notes—(a) Based on 5,278,306 shares in 1953 and 4,798,460 shares in 1952; (b) Based on 799,167 shares in 1953 and 685,000 in 1952; (c) Based on 10,447,423 shares in 1953 and 9,612,993 shares in 1952; and (d) Loss.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF JUNE 18-24			
Common Stock			
Gulf States Utilities—316,622 sh	$6,332	$20.00	6.00%
Preferred Stock			
Western Light & Telephone—78,202 sh 5½% cum conv $25 par (one sh of preferred being offered to commonholders for each five shares held on June 17 to expire June 30)	$1,955	$25.00	5.50%
SCHEDULE FOR JUNE—JULY			
Bonds			**Bid Date**
Pennsylvania Electric—1st mtg due 1983	$12,500	.....	June 30
Commonwealth Edison—1st mtg due 1983	40,000	.....	July 8
Consumers Power—1st mtg due 1983	25,000	.....	July 16(b)
Metropolitan Edison—1st mtg due 1983	8,000	.....	.....
Common Stock			
Boston Edison—246,866 sh (to be offered commonholders on 1-for-10 basis)	.....	.....	.....
POSTPONED, UNSCHEDULED, AND/OR UNDER CONSIDERATION			
Bonds			
Eastern Utilities Associates—collateral trust	$7,000	.....	.....
Monongahela Power—1st mtg	10,000	.....	.....
Public Service Electric & Gas—1st mtg due 1983	50,000	.....	.....
Louisiana Power & Light—1st mtg due 1983	12,000	.....	.....
Kansas Gas & Electric—1st mtg due 1983	10,000	.....	.....
Southern California Edison—1st mtg	25,000	.....	.....
Debentures			
Central Hudson Gas & Electric—conv debs	$6,000	.....	.....
Preferred Stock			
Kansas Gas & Electric	$5,000	.....	.....
Southern California Edison	15,000	.....	.....
Common Stock			
Iowa-Illinois Electric & Gas	$6,000(a)	.....	.....
Wisconsin Power & Light (probably on a 1-for-7 basis)	.....	.....	.....
Central Hudson Gas & Electric—140,000 sh (to be offered commonholders on 1-for-15 basis)	.....	.....	.....

Notes—(a) To sell enough common stock to yield $6 million; and (b) Morgan Stanley & Co will offer the bonds to the public in a negotiated deal.



New core design, developed by G-E engineers, reduces size and weight . . . improves performance of small power transformers

SMALL POWER UNITS NOW OFFER ADVANTAGES PIONEERED IN SPIRAKORE* DISTRIBUTION TRANSFORMERS

The most favorable losses, exciting currents, weights and dimensions of power transformers—all important to electric utilities—are obtained when the electrical advantages of grain-oriented cold-rolled core steel can be fully utilized.

This steel, known as Corisil, was developed in 1937 by General Electric in co-operation with Allegheny Ludlum Steel Corporation. First used in G-E Spirakore distribution transformers, it resulted in vastly improved performance characteristics and reduced size and weight. Since then our engineers have worked to develop new core designs that would provide these same benefits for power transformers.

Cold-rolled steel inherently provides two controllable characteristics of importance to both the transformer designer and user. These are directional properties and strain sensitivity.

Directional properties are advantageous. Cold-rolled steel is produced in continuous strips. With certain processing, a large proportion of the crystals are oriented so that magnetizing flux flows most easily in the direction in which the steel was rolled. When a core is designed so that the flux passes through the laminations in this way, lowest losses are obtained and the least magnetizing force is required.

Both core loss and magnetizing current are increased by mechanical strain to a much greater degree in oriented cold-rolled steel than in conventional hot-rolled steel. Consequently, the best core structure is one that minimizes strain on the core laminations.

Wound core designs as used in distribution transformers reduce strain to a minimum and permit flux to flow in the laminations parallel to the direction of rolling. Wound cores, however, are impractical for power transformer cores due to the size, weight and mechanical requirements of the latter.

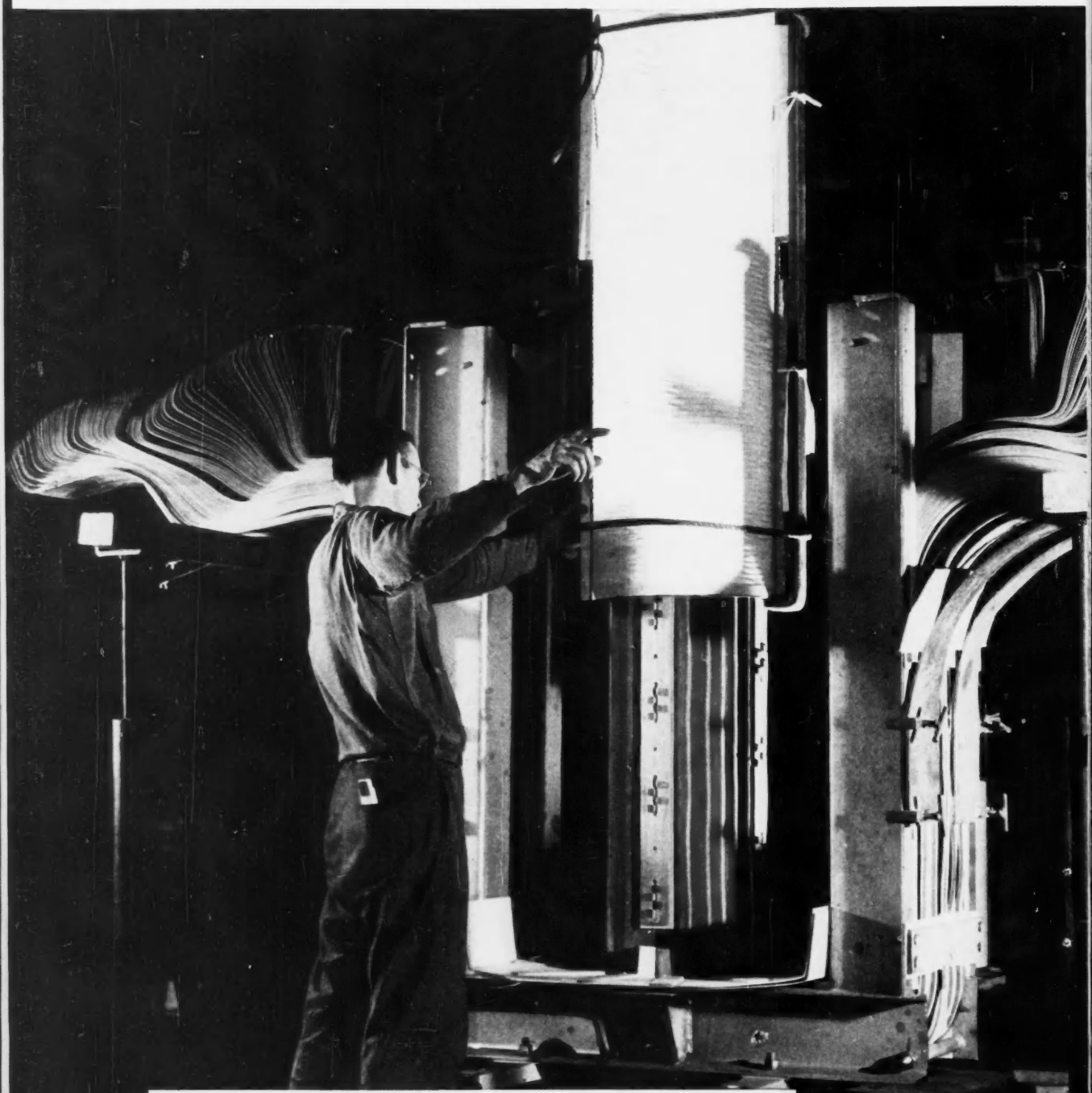
To meet these requirements, G-E engineers have produced the *precut, preformed* core . . . a new design which makes the many advantages of Spirakore distribution transformers available in small power transformers.

Registered trade-mark of General Electric Company

GENERAL ELECTRIC

For further details see next page

G-E Spirakore power transformers fully



LOWER AWAY—Low-voltage winding being placed on G-E Spirakore single-phase 3333-kva power transformer core. Supporting structures relieve annealed core of strain. When windings are in position, core ends are put back and upper clamping structure bolted in place.

utilize properties of grain-oriented steel

for smaller size, lower weight, improved performance

The Spirakore or preformed type of power transformer core is a low-strain, efficient magnetic circuit designed to take full advantage of the highly directional properties of cold-rolled, silicon steel. Completely new to power transformers, the preformed core provides the designer with greater flexibility than was ever possible with the conventional plate-type core. Weights and dimensions, losses, noise and exciting current can be controlled over a broader range to best meet a particular set of application requirements.

Improved operating characteristics of Spirakore power transformers result from the following:

1. Flux flows through the core laminations always in the direction of the grain thus reducing core loss and magnetizing current.
2. With only one joint per convolution, joint effects are almost negligible. Close-fitting construction reduces both losses and vibration in joint regions.
3. Laminations are not required to take lifting or short-circuit forces. Clamping structure cradles the core and transmits these forces so that no loss-producing strains are imposed on the core steel.
4. Flux distortion and harmonic generation which cause higher losses and noise in corner regions of plate-type cores are eliminated by the configuration of the preformed core.
5. Final anneal, after all piercing, shearing and forming operations, relieves strains and assures minimum losses in the completed core.

The preformed core is standard construction for General Electric single-phase power transformers rated 5000 kva and below. With the preformed core, losses, exciting current, noise level, weight and dimensions can be varied to best suit the conditions for your particular application.

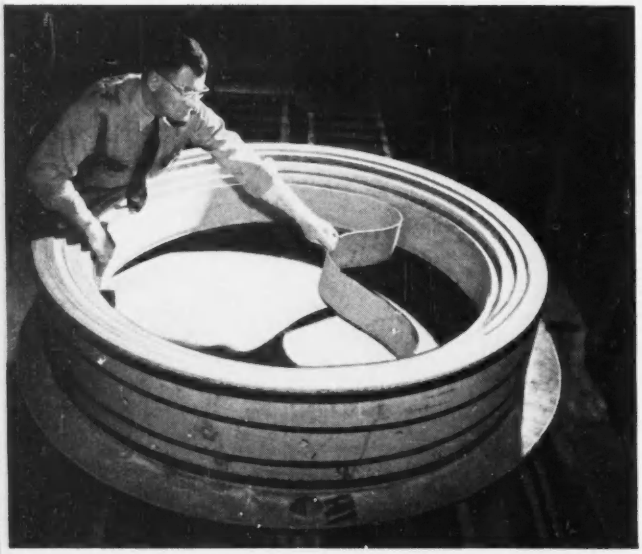
The Spirakore power transformer is another contribution from General Electric's continuing developmental program to give you more for your transformer dollar.

For more information on preformed cores, write to Section 421-11, General Electric Co., Schenectady 5, N Y.

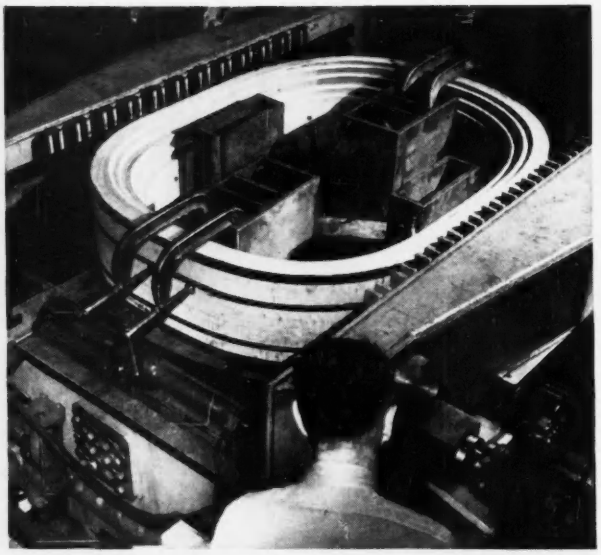
Progress in Power Transformers

GENERAL ELECTRIC

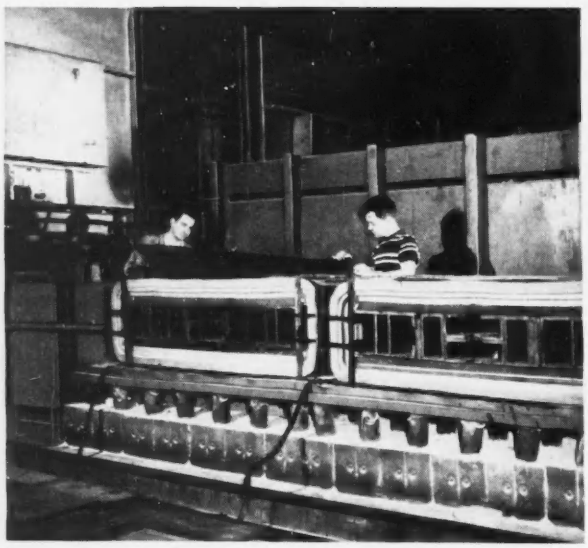
Flux flowing with grain in steel, no corner effect, small mechanical strain... features of G-E preformed core



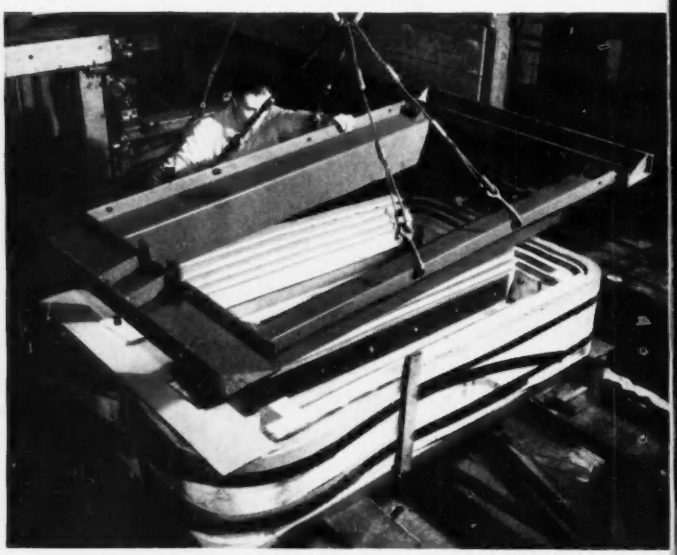
1 **COLD-ROLLED STEEL** laminations, cut in progressively decreasing lengths by automatic shear, are shown stacked into a ring prior to final forming.



2 **HYDRAULIC PRESS** forms ring into rectangular section. Two sections are required to complete the core. Continuous strip eliminates corner effects of plate-type core.



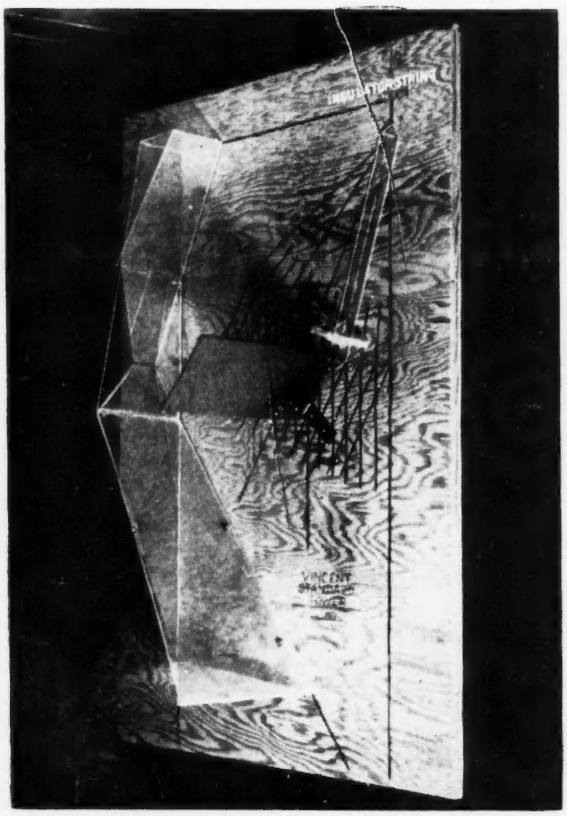
3 **FINAL ANNEAL** after forming relieves strains to hold losses down. Coating applied to laminations as they leave the shear acts as an insulator to limit eddy currents during operation.



4 **CLAMPING STRUCTURE** cradles core, takes lifting and short-circuit forces—prevents strain after final anneal. Insulation between clamps and core permits single point grounding.

You can put your confidence in—

GENERAL ELECTRIC



PLASTIC MODEL of steel tower is mounted on plywood base. Lines on base aid in positioning insulator string model and wire template

Measure Clearances Easily With Tower Models

H. D. FISCHER, JR., Engineer, Southern California Edison Co, Los Angeles

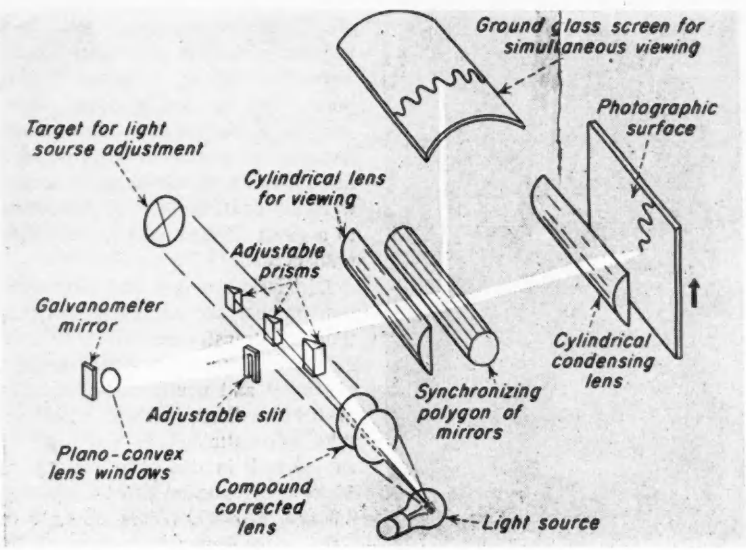
Normal and minimum clearances between conductor and tower steel are determined with great savings in time and satisfactory accuracy on scale models developed by Southern California Edison Co. Clearances to outside and center conductors may be measured on the models.

Built to a scale of 1 ft to 1 in., each model is made of sections of clear, rigid plastic cut to outside controlling shapes and dimensions of tower structure. Model is mounted on a piece of plywood on which is drawn scales representing various positions of insulator swing and vertical and diagonal lines representing no-wind load and an 8-lb wind load on the conductor.

Located on the plywood base is a pin positioned to correspond to the clevis bracket on the tower arm. To this pin is attached a plastic scale model of an insulator string. At conductor end of insulator string model is a hole into which fits a pin on a template of the conductor catenary, also of plastic. Calibrated curves drawn on the template correspond to various conductor slopes. These curves may be used independently of conductor type.

To use the model, it is first necessary to calculate insulator swing due to angle component and wind. Insulator string model and wire template are then placed in proper positions. Slope of conductor at point of support is determined and minimum clearances to tower steel are measured with a scale marked off in tenths of an inch.

Tips on Magnetic Oscillograph Operation



ESSENTIAL OSCILLOGRAPH COMPONENTS are shown including the light path from source to photographic emulsion. Movement of polygon mirrors provides sweep on ground glass screen

CHARLES TIRK, Senior Oscillograph Engineer, Westinghouse Electric Corp

Better understanding of the magnetic oscillograph adds to its usefulness as a tool to engineers studying the operation of electrical apparatus. Its "Duddell" (bifilar) galvanometers measure electrical quantities up to about 5,000 cps.

Light reflected from a mirror on the galvanometer can be observed visually or recorded on photographic film moving at controlled speed. This photographic trace has deflection proportional to the instantaneous value of current through the galvanometer and length proportional to time. Although generally used to record transient conditions, it also records such steady-state quantities as ac wave form and dc commutator ripple.

For best results, the oscillograph

operator should know the apparatus under test. He should also be given adequate information regarding the quantities to be measured and their probable maximum values. With these, he is ready to make tests.

The first film should be examined for possible improvements in test set up, and for a check on the operating condition of the oscillograph. It is desirable that it be examined by the equipment engineer as he may desire some changes.

The following tips will help the operator to get the best results from his oscillograph:

1. Use less sensitive galvanometers unless there is a limitation on metering current, as they have better frequency response.

2. Space the light beams from the various galvanometers properly to avoid confusing overlaps.

3. Keep all mirrors, prisms and windows clean.

4. Check each galvanometer by moving it slowly and observing motion of its light spot on the viewing screen. Smooth motion indicates proper clearance from its magnets. Jumpy movement indicates contact, and the galvanometer should be replaced.

5. Observe the brightness of the light spots. Low intensity may denote a deteriorated lamp. A discolored spot indicates discoloration of the damping fluid which should be replaced at least once a year. The optical system must be in good order before tests are started.

6. Be sure that switch and resistor contacts on the attenuator panels, and fuses and fuse holders, are clean and free from dust. They should be polished at least once a year to keep the millivolt drops low. Low resistance fuses help when maximum sensitivity is essential.

7. Avoid excessive deflection of the galvanometers. It strains the ribbon and may loosen the mirror. When severe deflections are required, calibrate the galvanometers before and after each test.

8. Use external resistors when abnormal currents are encountered to avoid damaging the attenuators.

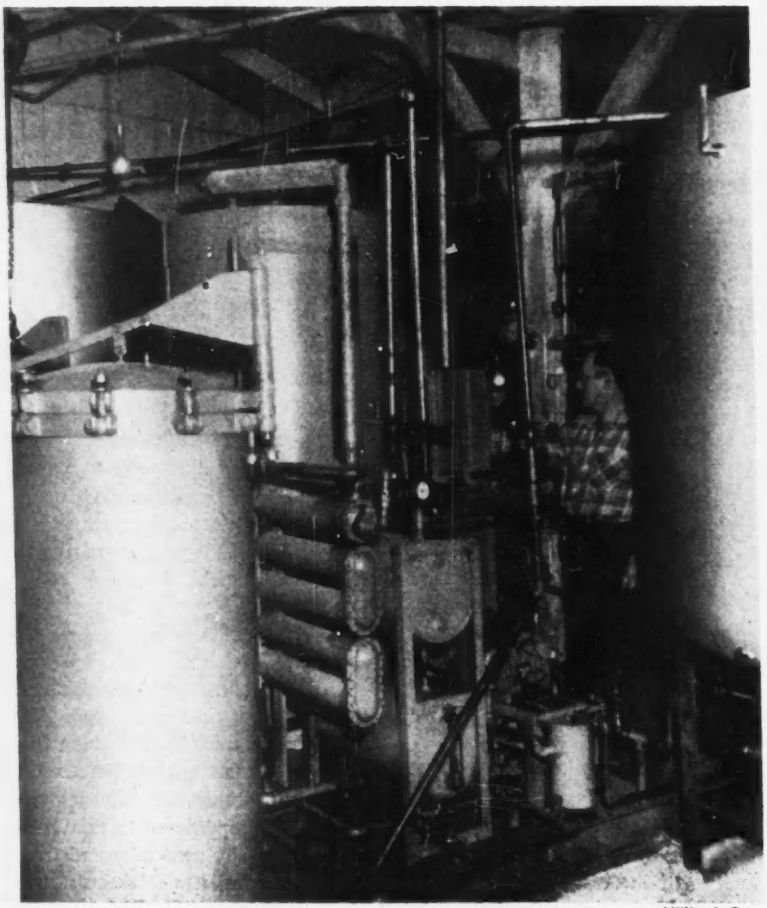
9. Measure dc current with shunts.

10. Make shunt loops small and use twisted pair for connections to the galvanometer to minimize inductance and pick up from stray magnetic fields.

11. Keep the film holder clean. Small foreign particles in the slot interfere with the light beams.

12. Use X-ray developer and fixer as they are fast and give excellent contrast.

Reclaimer Cuts Annual Transformer Oil Cost $4,000



Hilliard Corp

PURIFYING OIL is accomplished with this reclaimer. Clean oil tanks are in rear, reclaimers are in foreground and part of dirty oil tank is at right

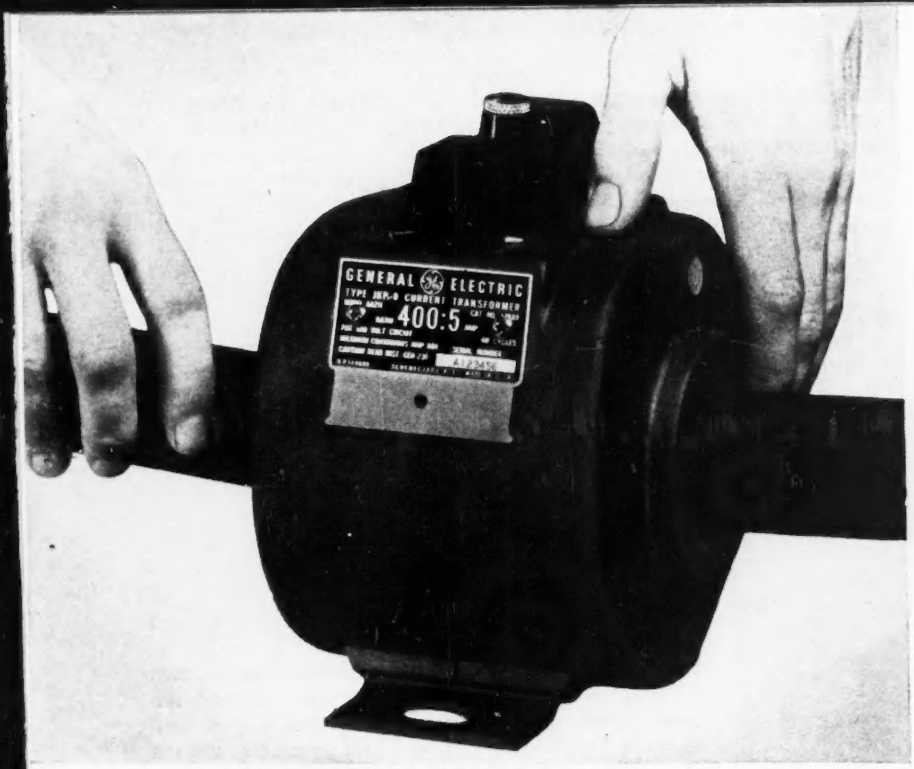
Purifying transformer oil with a reclaimer cut Cincinnati Gas and Electric Co's oil bill more than $600 a month in the first three months of service. Annual savings are expected to be about $4,000 for reclaiming an expected $25,000 gal of oil. Characteristics of the reclaimed oil in many respects are equal to new oil.

The reclaimer is a miniature refinery. Contaminated oil, accumulated in a tank, is pumped through a heat exchanger, which is heated by outgoing clean oil, filtered through water-resistant fuller's earth, and heated in a vacuum. Moisture and other volatile impurities having a lower boiling point than oil are removed under vacuum, condensed in a distillate tank, and drained to the sewer. Hot purified oil flows to the heat exchanger, warming contaminated oil, and then to a clean oil tank where it is stored until needed.

Dielectric strength and neutralization number are important specifications of transformer oil. Contaminated oil having a dielectric strength of 18 kv and neutralization number of 0.9 has been purified. Good results were attained as indicated by an increase in dielectric strength to 30 kv and reduction of neutralization number to 0.047. These values were equal to or better than required by the company's oil specification.

During the first three months of

operation the reclaimer processed Transformer oil reclamation is one taminated oil tank for processing.



BUTYL-MOLDED, OPEN-WINDOW DESIGN JKP-0 indoor-outdoor versatility. Cut your stock and inventory costs with JKP-0 indoor and outdoor 600-volt applications.

4 in 1

NEW G-E CURRENT TRANSFORMER REPLACES 4 STANDARD MODELS

An outstanding advantage of the Type JKP-0, 600-volt butyl-molded current transformer is its versatility —it easily replaces 4 different types. Here are four ways the JKP-0 saves you money:

1. STOCKING COSTS REDUCED. Standardizing on the JKP-0 cuts costs by reducing stock requirements, simplifying ordering.

2. MAINTENANCE IS REDUCED. JKP-0 transformers will not corrode, breakage is reduced, no painting is needed—JKP-0 is butyl-molded.

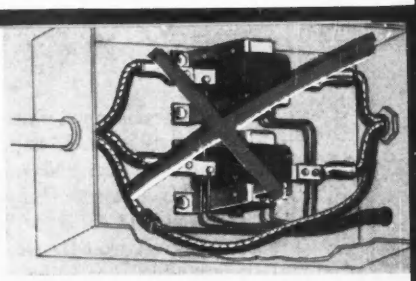
3. INSTALLATION COSTS CUT. The JKP-0 does not require elaborate arrangements of crossarms, hanger connections, etc.—and the amount of wiring is reduced.

4. LOWER INITIAL COST. This versatile transformer sells for less than most of the conventional types it replaces.

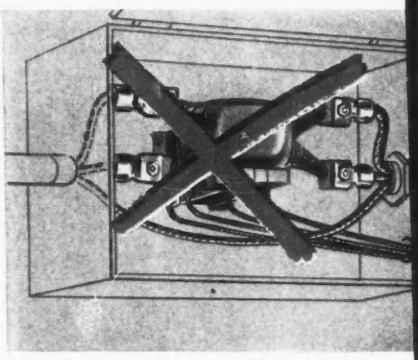
Write or call your nearest G-E Apparatus Sales Office, or authorized agent or distributor. Ask for Bulletin GEA-5874. General Electric Company, Schenectady 5, New York. 604-38

You can put your confidence in—

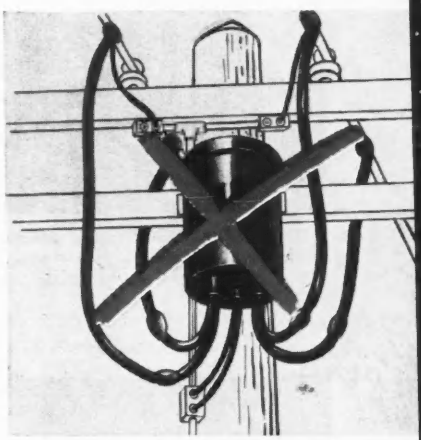
GENERAL ELECTRIC



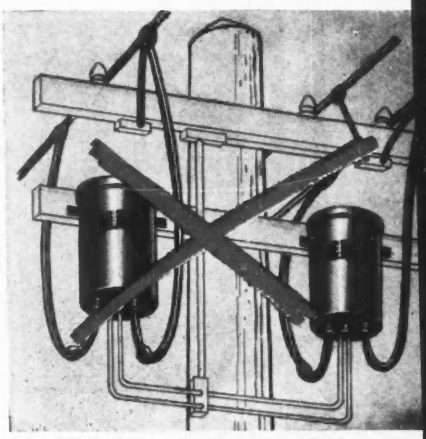
REPLACING INDOOR JL-1 (or newer JKR-0) with the JKP-0 means simplified wiring, fewer connectors—cut costs!



CARRY ONE MODEL in stock instead of four! Above: JKR-1, another transformer easily replaced by the new JKP-0.



FOR OUTDOOR JOBS the JKP-0 eliminates costly crossarms and connectors demanded by conventional Type JKB-1.



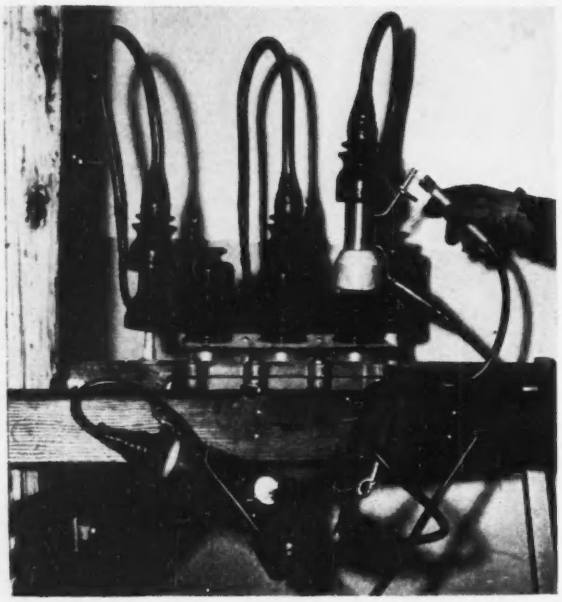
ANOTHER OPPORTUNITY to standardize is realized when butyl-molded JKP-0 replaces JKB-2 outdoor current transformer.

operation the reclaimer processed 12,650 gal of transformer oil at a cost including labor, material and amortization of $1,075. Contaminated oil could have been sold for $1,265 but this quantity of oil would have cost $4,301 if purchased new. Therefore, oil reclaiming resulted in a $1,960 savings.

Transformer oil reclamation is one step in periodic servicing of transformers. At intervals, ranging up to nine years for ordinary pole-mounted transformers in residential districts, crews replace transformers with new or reconditioned ones.

Oil from transformers returned to shop is stored in the reclaimer's contaminated oil tank for processing. Transformer cases are flushed, checked for leaks, repaired and repainted. Windings are checked and cleaned. Leads are stripped, inspected, and retaped.

After reassembly, transformers are tested, renumbered, and placed in the stock room.



POTHEAD PHASING is readily accomplished with a special insert, which has two external connections—one connects to the male fitting, and the other to the female fitting in the insert

Pothead Insert Facilitates Phasing

WALTER G. EDELBLUTE, Engineer, Electrical Construction Department, Overhead, Commonwealth Edison Co, Chicago

A pothead insert has been developed by Commonwealth Edison Co for testing and phasing out 4-kv circuits at air-break potheads. When the insert is connected between the pothead cap and tube, two electrically isolated, stationary, readily accessible test points are provided. A fused test stick or a phasing voltmeter may be used as the test instrument.

Before the test insert was developed it was necessary to test between the contacts in the pothead cap and pothead tube. Difficulty was experienced with this method because the pothead cap is connected to a flexible cable, which is subject to movement, and neither test points was readily accessible.

The insert, which is about 5 in. high, is made from linen base, high dielectric, bakelite and modified 7.5-kv pothead connectors for the plug and socket. Modification of the connectors was necessary so they could be used on either 250- or 500-amp potheads.

RACKING UNIT, mounted on tripod and casters, has socket shaft for raising and lowering circuit breakers enclosed in cubicles

Motor-Driven Racker Raises and Lowers Breakers

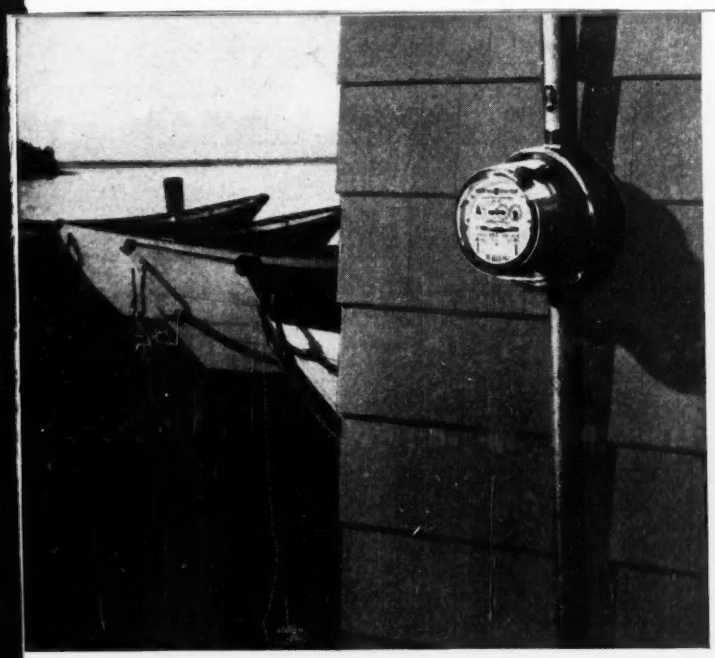
ROY PETERSON, Substation Foreman, The Ohio Power Co, Canton, Ohio

A Motor-driven racking unit has greatly reduced time required for racking circuit breakers in switchgear cubicles, during overhaul periods.

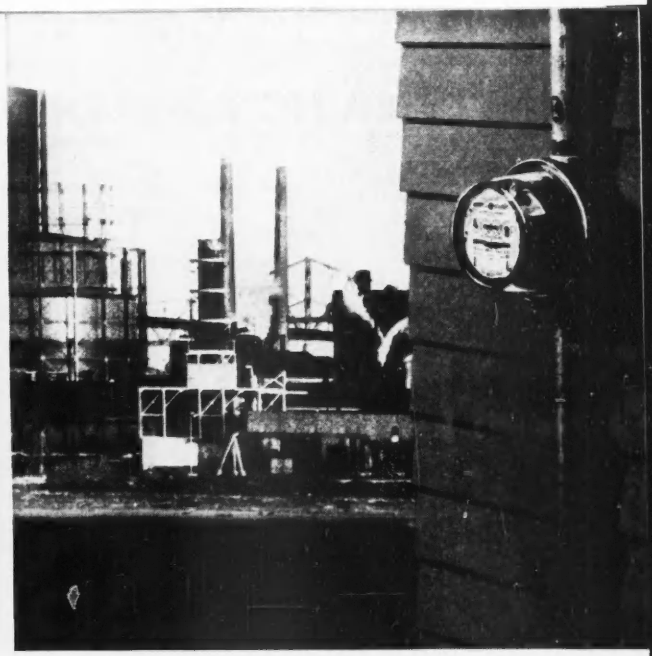
The unit consists of a reversible 1/3-hp, 1800-rpm, 115-v single-phase motor; a 30:1 horizontal, single-reduction worm gear; a socketed racking shaft containing two universal joints; a reversing switch; an "on-and-off" switch; a tripod stand with adjustable legs and casters; and an extension cord with plug.

Reduction gear has an input shaft that can run in either direction. Racking shaft is attached to the breaker raising and lowering mechanism by a close-fitting socket.

Cost of the motor and reduction gear was $30, and the assembly of other stock parts required 16 man-hours. A slip clutch may be added to prevent jamming the breaker when it reaches the upper or lower position.



In Salty Coastal Atmospheres . . .



In Corrosive Industrial Atmospheres . . .

Certified I-50 Meters Offer Dual Protection Against Corrosion—Both Inside and Outside

Field tests in coastal and industrial areas have proved that the General Electric certified I-50 meter offers outstanding protection against corrosion, both inside and outside. Such dual protection cuts costs normally expended for cleaning, painting, and general maintenance.

ALL EXPOSED SURFACES of both the socket-type and front-connected I-50 meters are made of materials designed to resist corrosion. For example, the front-connected type meter has an aluminum terminal cover, cover ring, bayonet clips, sealing bar, etc. The socket-type meter has a Textolite* base; its glass-cover rings and the socket sealing-rings are of stainless steel.

ALL INTERIOR PARTS of both the A- and S-type I-50's have been given special treatment to reduce corrosive action within the glass cover.

*Reg. Trademark of General Electric Company

BOTH OF THESE METERS adequately meet the "Class I General-purpose Finish" standards established by NEMA. In addition, tests and field experience in locations having exceptional corrosion hazards show that the S meter meets NEMA's "Class II Corrosion-resistant Finish" standards. The Textolite base and stainless-steel cover-ring combination is ***unaffected by any materials*** used for sockets or socket-sealing rings.

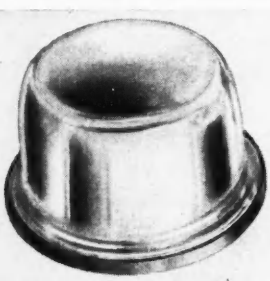
FOR MORE INFORMATION, call your G-E representative. Ask to see the new color motion picture "Accent on Accuracy." General Electric, Schenectady 5, N. Y.

601-97

You can put your confidence in—

GENERAL ELECTRIC

ONLY CORROSION-RESISTANT MATERIALS—glass, textolite, and stainless steel—are used for all exposed surfaces of certified socket-type meters. And all G-E sockets are sold with stainless-steel sealing-rings—an exclusive General Electric feature.



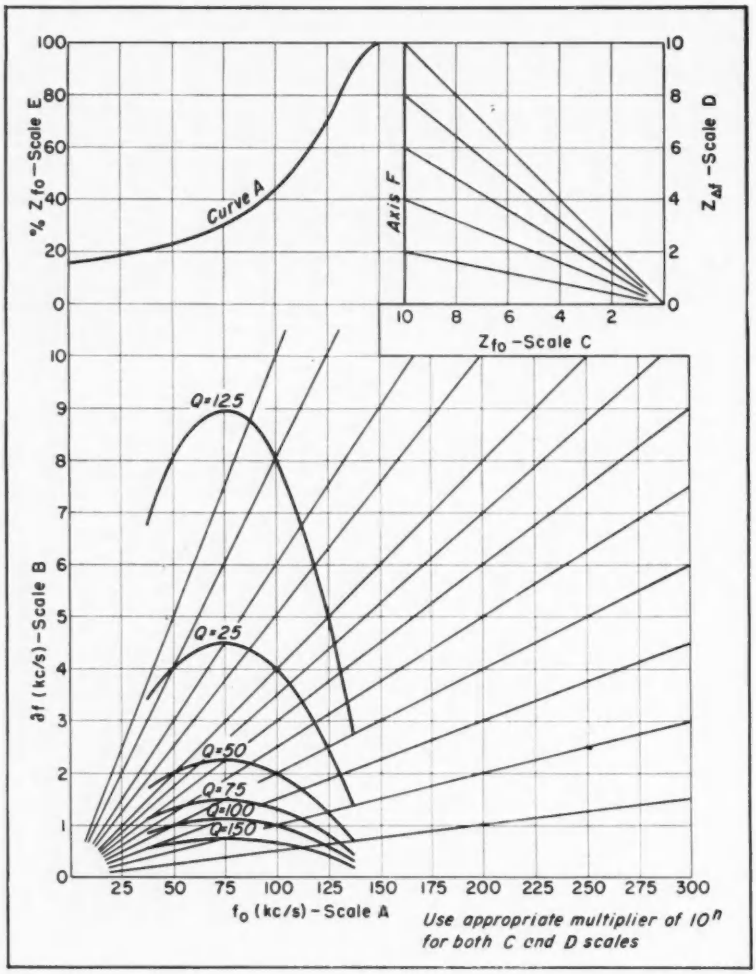
STAINLESS STEEL COVER RING

TEXTOLITE BASE PLATE

STAINLESS STEEL SOCKET SEALING RING

Determination of Q and

J. D. MOYNIHAN, Electric Utility Engineer, Westinghouse Electric Corp., East Pittsburgh, Pa.



This combined graph is applicable (A) for calculations* involving single-frequency line traps with a Q of 10 or more, and (B) for determining impedance variations over a narrow band of frequencies.

Here $Q = X_L/R$ = quality rating of a resonant circuit

f_o = carrier frequency in Kc/s.

(A) To determine the Q of a single-frequency line trap, the steps are as follows:

1. Measure the impedance at its resonant frequency. This can be determined by using the conventional voltage across the trap and current through the trap.

2. At another frequency, $f_o \pm \delta f$, measure the impedance as in step 1. (δf should be between 1 and 5 kc)

3. Enter with the values of f_o on scale A and δf on scale B, and determine the point of intersection.

4. Draw a line from the origin of scales A and B through the point determined in step 3.

5. Enter scale C with the measured impedance at the resonant frequency. Enter scale D with the impedance measured at $f_o \pm \delta f$. Determine the point of intersection and draw a line through that point to the origin of scales C and D.

6. Where this line, determined from scales C and D, intersects axis F, project horizontally to the left until curve A is intersected.

7. At the point of intersection with curve A, project a line vertically downward until it intersects the line drawn in step 4.

8. Read at this intersection the value of Q by interpolation on a vertical scale between the various Q curves. This is the value of Q for the trap in its present state.

(B) To determine the maximum value of Q which will allow some given percentage deviation of impedance for a given band width, the steps are as follows:

1. Determine the value, in terms of percent of impedance at resonant frequency, that the impedance at $f_o \pm \delta f$ should not be below, and enter this percentage of Z_{f_0} on scale E.

2. Project horizontally right to curve A, then vertically downward to scale A.

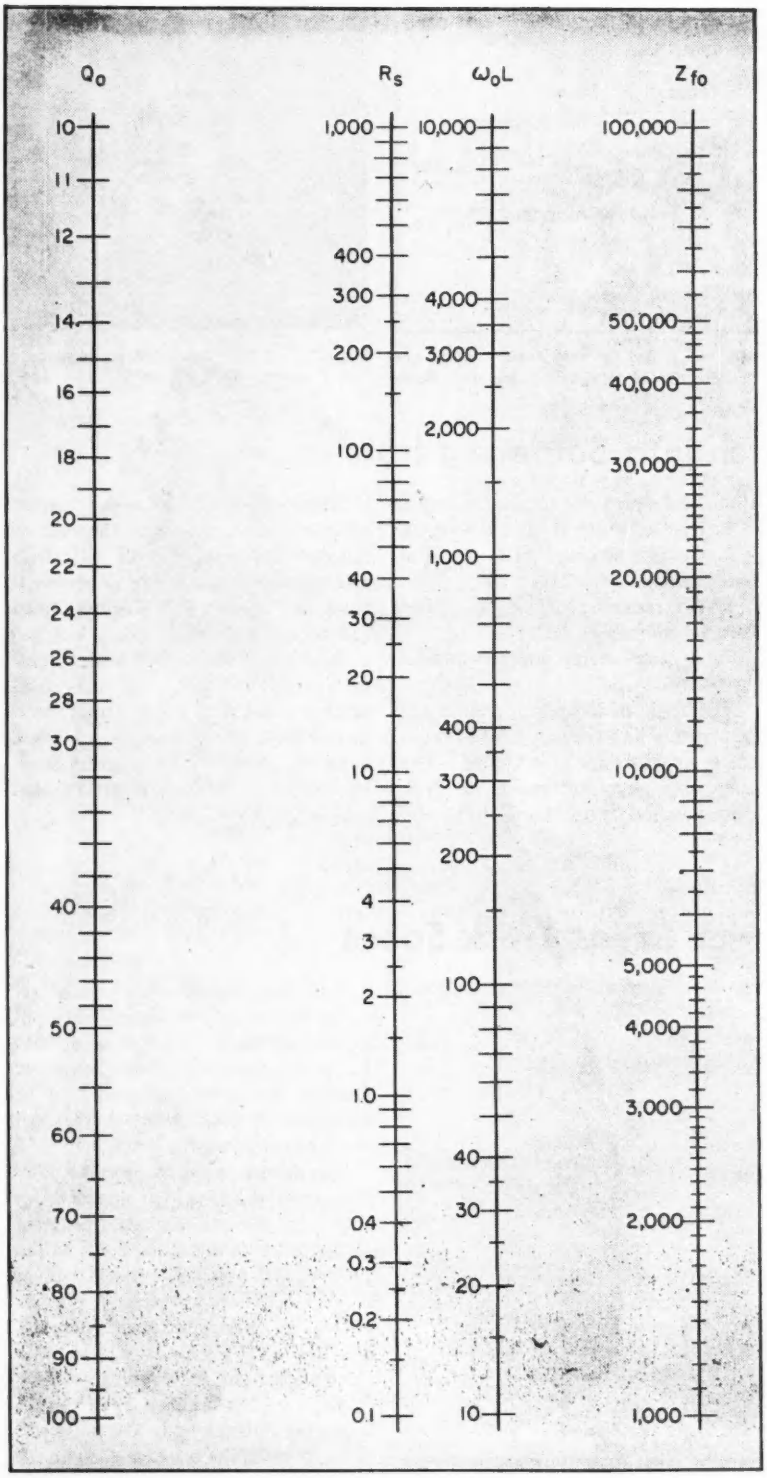
3. Determine the center frequency (f_o) and the previously desired value of δf, then enter scales A and B with these values.

4. From the point of intersection of the two values determined in step 3, draw a line to the origin of scales A and B.

5. At the intersection obtained in step 4, and the vertical line obtained in step 2, the desired value of Q can be determined by interpolation on a vertical scale between the various Q curves.

*In a line trap similar to Westinghouse "P" series, the inductance is divided between the two arms of the trap and therefore the caluculated value of R will not lower the Q quite as much as the calculations indicate

Resistance of Line Traps



Nomograph is suitable for calculations* involving single-frequency line traps with a Q of 10 or more. It is applicable to determine the resistance required to de-Q the trap.

Here $Q = X_L/R$ = quality rating of a resonant circuit,
Z_{fo} = impedance at resonant frequency
Q_o = Q at resonant frequency
R_s = total resistance needed for a given value of Q
$\varphi_o L = X_L$ at resonant frequency

To determine the value of resistance that must be added to the parallel tuned circuit to obtain the low value of Q required (de-Q), the steps in using the nomogram are as follows:

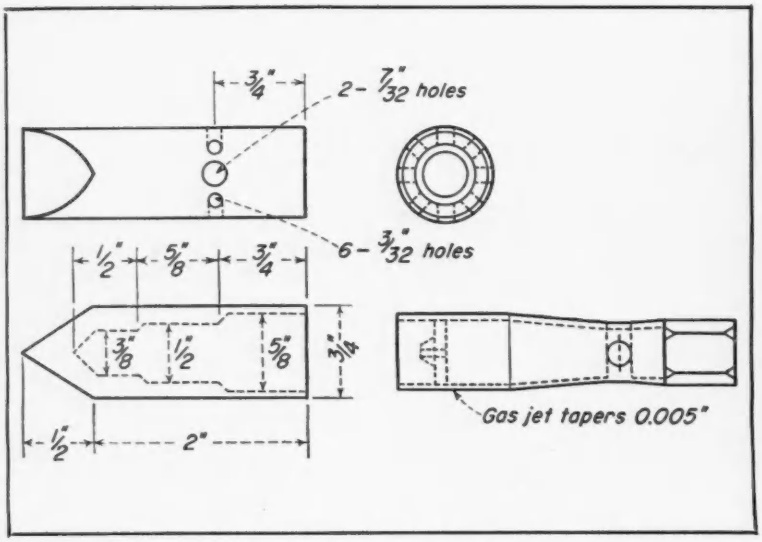
1. Mark the present value of Q on the Q_o scale. Mark the value of Z_{fo} of the present trap on the scale Z_{fo}.

2. Using a straight edge between these two points, determine the present value of R on the R_s scale and the value of $\varphi_o L$ on that scale.

3. Draw a line from the point just determined on the $\varphi_o L$ point to the desired value of Q on the Q_o scale. Where this line crosses the R scale, the total value of resistance needed for the lower Q trap can be read.

4. By subtracting the present value of R from the required value of R, the additional resistance required to de-Q the trap will be known.

*In a line trap similar to Westinghouse "M" series, the inductance is tapped and as a result there is some transformer action. Therefore, the calculated value of R will decrease the Q a little more than the curves would indicate. However it appears that these errors will be negligible in a majority of cases



SOLDERING IRON is made from ¾-in. diam bronze and drilled for slip fit over propane-gas jet head. Gas-expulsion holes in the soldering iron are needed to light and maintain flame

BRONZE SOLDERING IRON attached to a No. 1 propane-gas jet head

Attachment Turns Torch into Soldering Iron

T. LEO SALES, Foreman, Underground Network Construction Indiana & Michigan Electric Co, Fort Wayne, Ind.

A soldering-iron attachment added to a No. 1 propane gas torch has facilitated soldering underground joints where electricity is not available. It is especially applicable for soldering high-voltage joints involving copper braid and stress cones. Costing $2.50 to make from bronze in one hour, it uses a small amount of gas to maintain the proper "iron" temperature and provides these features:

1. Ease of assembly and operation.

2. Quick heating and uniform temperature.

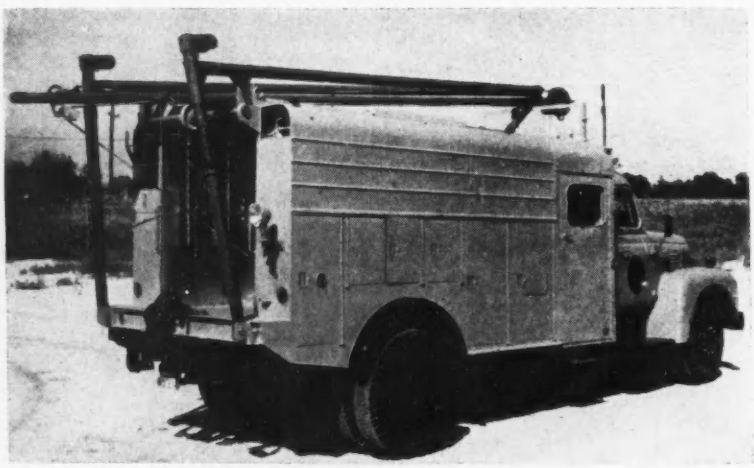
3. No retinning or cleaning after several months of use.

4. A time saving method, usable anywhere.

The angle of the torch head is advantageous in soldering hard-to-get-at places or where space is limited. The long hose does not make the iron clumsy to handle nor limited in its use.

After completion of soldering, or when the gas-torch flame alone is required, the combined torch head with soldering-iron attachment is removed from the hose. The soldering iron can be easily removed because it has a slip-fit instead of a threaded joint that might "freeze" after continued heating. The next larger size of torch head (No. 2 jet) is used when a torch flame is required. The two heads (No. 1 & 2) serve all joint-making and soldering needs.

Two Man Folding Derrick Saves Truck Space



WINCH LINE run through pulley near bottom of stiff leg raises derrick to operating position

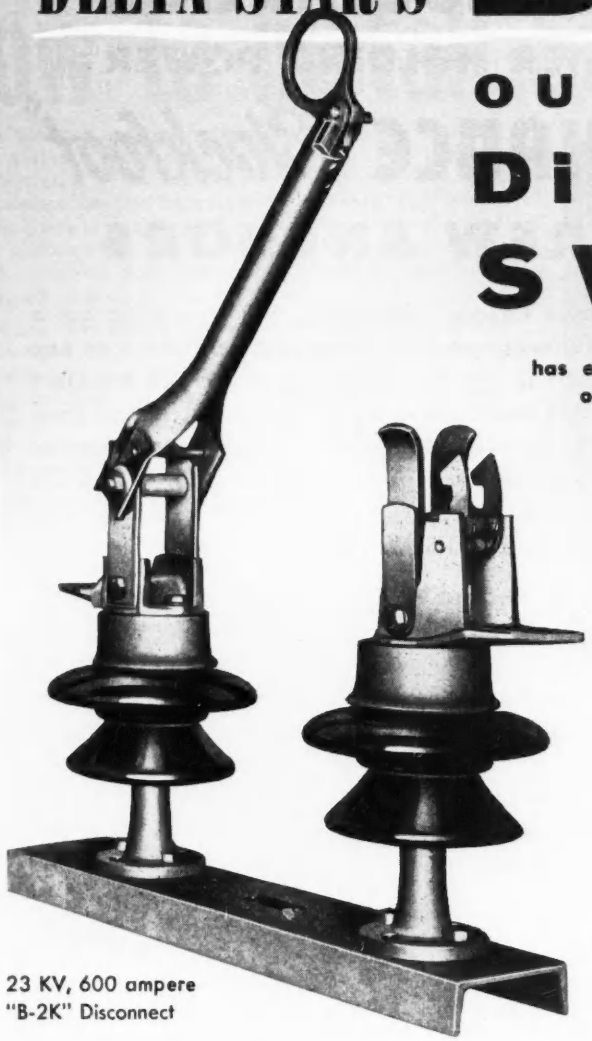
A folding derrick that can be set up by two men is the main feature of an all-purpose line truck now in service on Tacoma City Light's system. Derrick also saves space on floor or alongside of truck, which is required by standard stowaway types.

The derrick is raised by a line running from a stiff leg to a winch, located just behind the cab. Stiff leg anchors to truck deck and holds unit in fully raised position. Steel pins in metal bracket above the hinge on outboard legs hold derrick in operating position.

To anchor unit in travelling position, folding legs are fastened by steel pins to the top of truck body and pully end

(*Continued on page* 110)

DELTA-STAR'S B-2K OUTDOOR Disconnect SWITCH



23 KV, 600 ampere
"B-2K" Disconnect

has everything you could possibly ask for in an outdoor disconnect switch with tested and proved electrical and mechanical advantages.

IMPROVED THERMAL CHARACTERISTICS

Hard drawn copper contact shoes with ample material for heat dissipation. Hard drawn tubular copper blade constructed to avoid any possibility of contact misalignment.

HIGH PRESSURE LONG-LIVED CONTACTS

Contact shoes have heavy rolled silver inlays at points of contact which press firmly against copper blade. Pressure maintained by fatigue resistant beryllium copper alloy cantilever springs. Contact at hinge end made by blade operating against silvered hard drawn copper bars.

RIGID BLADE CONSTRUCTION

The hard drawn tubular copper blade is split and flared at the hinge end which gives it great transverse stability. No possibility of contact misalignment. A cast bronze insert is riveted inside the blade at the clip end to prevent distortion when slamming it closed.

IMPROVED BLADE PRYOUT

Operation is quick and easy in all types of weather with positive, effortless operating blade pryout and lock assembly, and large 3-inch hook ring. A slight pull on the hook ring is all that is necessary to break ice or corrosion accumulations.

"B-2K" Switches are available in single and double throw for upright and inverted mountings, in current ratings of 600 and 1200 amperes and in voltages up to 161 KV.

ASK FOR PUBLICATION 5104

WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHING EQUIPMENT SPECIFY DELTA-STAR

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
2437 FULTON STREET, CHICAGO 12, ILLINOIS
DISTRICT OFFICES IN PRINCIPAL CITIES

H. K. PORTER COMPANY, INC.

For Easier Installation

...GREATER HOLDING POWER

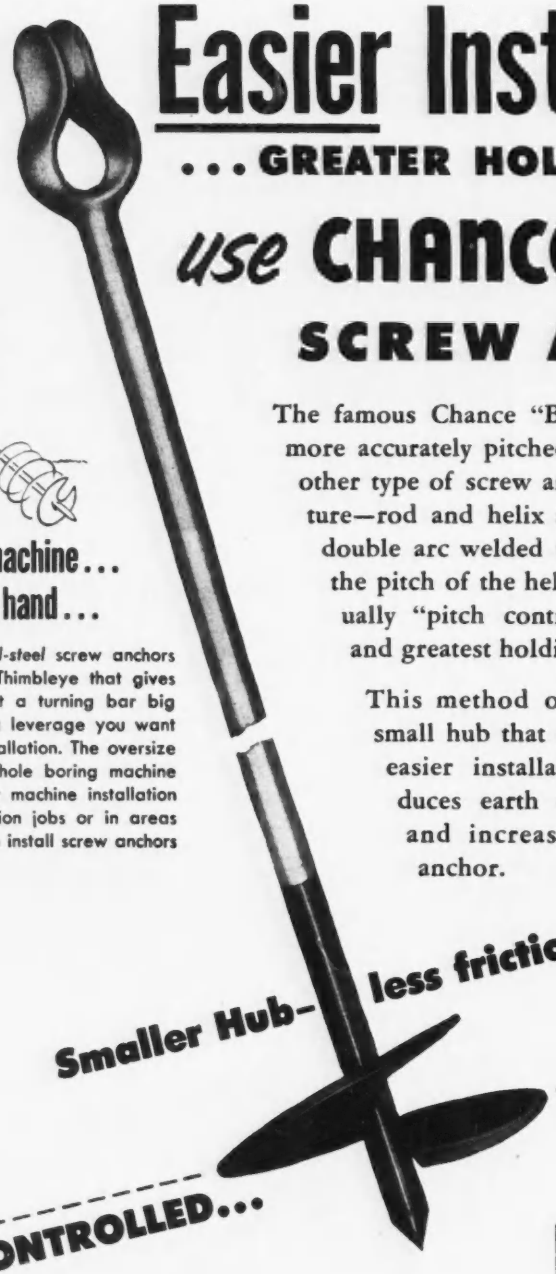
use CHANCE "Blackfoot" SCREW ANCHORS

Install by machine...
Install by hand...

Chance one piece *all-steel* screw anchors have a "king size" Thimbleye that gives ample room to insert a turning bar big enough for the extra leverage you want for speedy hand installation. The oversize eye will readily fit hole boring machine adapters that permit machine installation on big line construction jobs or in areas where it is difficult to install screw anchors by hand.

The famous Chance "Blackfoot" Screw Anchor has a more accurately pitched, faster cutting blade than any other type of screw anchor. The method of manufacture—rod and helix are formed separately and then double arc welded together—puts no limitation on the pitch of the helix. Every size anchor is individually "pitch controlled" for fastest installation and greatest holding power.

This method of manufacture also permits a small hub that creates less friction and means easier installation. The small hub also reduces earth disturbance during installation and increases the holding power of the anchor.

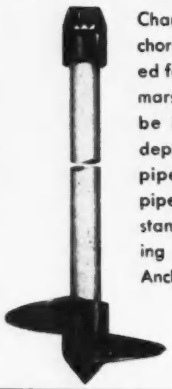


Smaller Hub—less friction

to go down faster!

PITCH CONTROLLED...

CHANCE SWAMP ANCHOR



Chance Swamp Screw Anchors are specifically designed for installation in swamps, marshes, and sand. They may be installed to necessary depth to reach firm soil with pipe wrenches, chain-type pipe tongs, or, where circumstances permit, by hole boring equipment. The Swamp Anchor has a large Tripleye nut to accommodate one, two or three guys.

You know it's RIGHT when you specify CHANCE

A·B·CHANCE CO·

CENTRALIA, MISSOURI
SAN FRANCISCO, CALIFORNIA

ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS

NUMBER TWO OF A SERIES

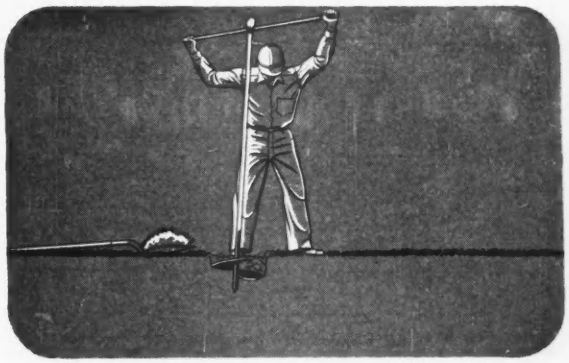
TIPS FOR BETTER ANCHORING...

How to install Screw Anchors

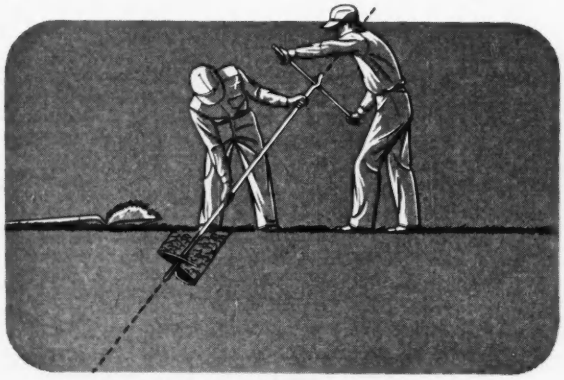
Screw anchors are generally used in loose soils such as sand, gravel, cinders, etc. They can also be used in fairly dry, firm clay. These anchors are quite popular for light to moderate loadings because of their ease of application. Holding power is substantial, comparing favorably with other anchor types of the same size. Screw anchors are easily retrieved and therefore particularly suited for temporary guying.

There are three general types of screw anchors available: the no-wrench type, that can be installed by hand, or, with the addition of a simple coupler, by your hole boring machine; the square shank or wrench type, to be screwed in with a standard screw anchor wrench; and the swamp type, specifically designed to be deeply set in swamps, marshes, or quicksand.

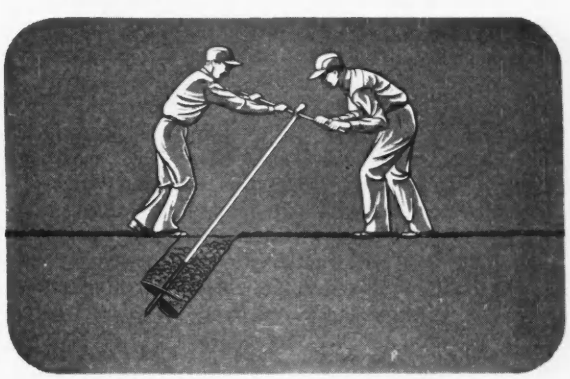
To help you get the best results and reduce the effort required to make screw anchor installations, the A. B. Chance Company, makers of all types of earth anchors, presents here the most successful field practices:



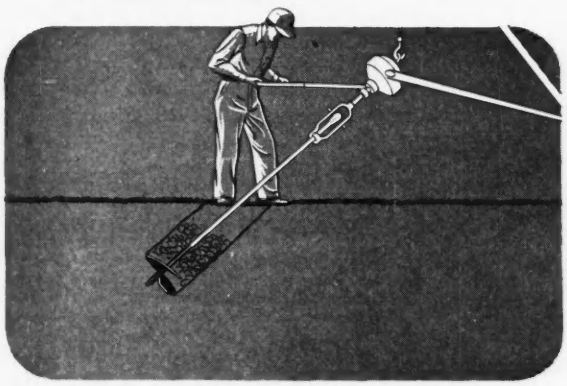
1. If earth crust is hard, remove a shovel full of top soil to help start anchor blade and bore down vertically until blade takes hold. Pull over for proper alignment when screwing down.



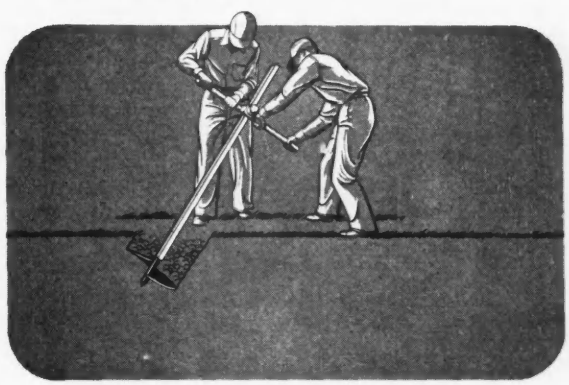
2. Anchor should be screwed down in line with guy to prevent line sag or bending of the rod and give maximum holding power. To start angle installation, one man holds anchor in proper alignment.



3. To install by hand, use a steel bar or section of pipe. Two men are better than one on larger anchors. For maximum soil holding power, no more than 6" of rod should extend above ground.



4. You can also install screw anchors mechanically with your hole boring machine. The eye will fit an adapter available from most hole boring machine manufacturers.



5. To install wrench type screw anchors with detachable thimbleye nuts, remove nut, slide wrench over rod and fit to square shank, screw anchor down, remove wrench and attach thimbleye nut.

Reprints of this advertisement for your bulletin board, or for distribution to your men, are yours for the asking. Request Form 31, Screw Anchors. Write A. B. Chance Company, Centralia, Mo.

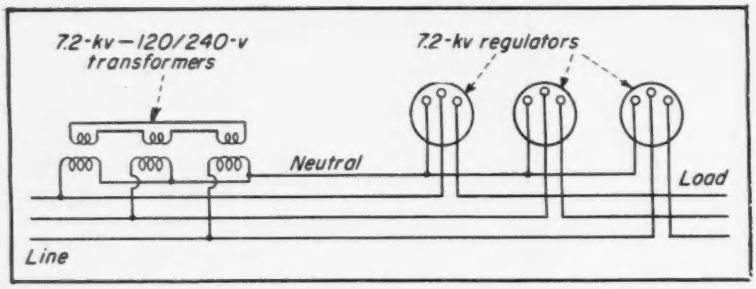
C53-7

Folding Derrick

(*Continued from page* 106)

is chained to carrying mount over cab. Other features of truck include a double-drum winch and a ventilated and heated crew cab which is also equipped with escape windows. Cost of folding derrick is about $850 while cost of body and crew cab is $4,463, including winch.

7.2-Kv Regulators For 12-Kv Feeders



THREE-PHASE 12-KV REGULATION is provided by three single-phase, 7.2-kv regulators and three transformers. For 15-amp units, transformers are 5 kva; for 50-amp units, 15-kva each

WARD HAMMOND Distribution Engineer California Oregon Power Co, Medford, Ore.

Availability of single-phase units prompted California Oregon Power Co to use three single-phase, 7.2-kv regulators connected in wye to regulate 12-kv, three-phase, three-wire feeders. Capacity of the feeders is such that cost of high-capacity three-phase units could not be justified. Believed to be the first installation of this type, it permits advantage to be taken of the more satisfactory regulation offered by single-phase regulators over three-phase units.

As shown in the illustration, to provide the necessary fixed neutral for the regulators, three 7,200-120/240-v distribution transformers are connected wye-delta with the neutral point taken off the high side. For 15-amp regulator combinations, 5-kva transformers are used; for 50-amp regulators, 15-kva units are used. Regulators are mounted on a platform and transformers are mounted on crossarms one span distant.

6,000-Amp Transformer For CT Testing

LEE A. BAUNSGARD, Electric Meterman Foreman, Seattle City Light, Seattle, Wash.

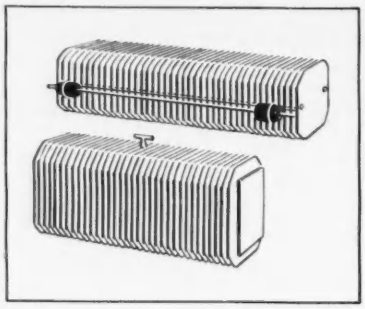
LOADING TRANSFORMER is designed for use in any position. It may be hoisted up to bushing transformers to shorten secondary

A portable loading transformer designed and built by Seattle City Light permits field testing of any type of current transformer rated up to 6,000 amp. It is particularly useful in checking bushing transformers located at some height above ground or floor level. Unit is constructed so that it may be used in any position.

Heart of transformer is a 5-kva, oriented-grain iron core from a standard distribution transformer. Primary winding consists of 80 turns of No. 6, square, glass-covered copper wire; secondary is a specially forged 3-turn, $\frac{1}{8}$ x $1\frac{1}{8}$-in. cast-copper winding with a minimum conductivity of 85%. Secondary terminals are extensions of the winding and provide one-turn, two-turn, or three-turn loops. Two holes per terminal allow sufficient con-

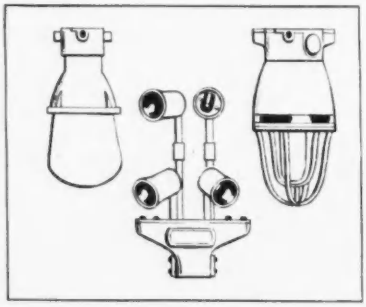
(*Advertisement*)

Electrical Applications of Aluminum



Lightweight Collector Plates

Collector plate assemblies for electronic air filters offer definite advantages when aluminum is used in their construction. For example, lightweight aluminum makes it easy to remove collector plates for cleaning and recoating—a distinct sales advantage over conventional heavyweight filter plate materials. Also, the light weight of aluminum permits easy lifting and precision alignment of the assemblies in manufacture. While not an adsorptive itself, aluminum readily lends itself to a process of slight etching which provides a capillary surface for the retention of a heavier film of oil which traps impurities out of the air. This process tends also to round the edges of the plates which reduces electrical losses in the filter. The low cost of aluminum makes it practical to keep a spare set of assemblies on hand for immediate replacement, which cuts down time the filter has to be out of service for maintenance.



Better Die Cast Lighting Fixtures

The light weight, rustproof qualities of aluminum provide safe and economical operation of lighting systems that must function at peak efficiency despite exposure to severe climatic conditions. Fixtures of this type, made by leading companies from Reynolds Aluminum, offer the manufacturer—as well as the user—definite advantages. Die cast fixtures are easy to machine, can be produced quickly, are low in cost.

Write to Reynolds for details on the subjects above and also for details on the many other applications of aluminum in the electrical field.

REYNOLDS ACSR and REYNOLDS ELECTRICAL ENGINEERING SERVICE solve a RAILROAD AND HIGHWAY CROSSING PROBLEM

A Missouri Corporation* recently asked Reynolds engineers for assistance with a particularly difficult section of line being relocated because of new highway construction. This section of line was about 2200 feet long and involved a difference of about 200 feet in elevation between the highest and lowest points in addition to railway and highway crossings. Reynolds engineers made complete recommendations for construction including sizes and types of conductor and overhead ground wires, height and types of structures, guying details and furnished complete sag and tension data. Full study was made by Reynolds on all related factors including strength, electrical conductivity, lightning protection and electrical clearance between conductors.

The experienced help of Reynolds Electrical Engineering Service is available without cost to Reynolds cable customers. This service, plus the savings in original cost, handling costs and field costs offered by Reynolds ACSR, make a combination that is well worth looking into. Remember—Reynolds engineers will also be glad to conduct a meeting with your men and present design and fabrication information on all phases of electrical applications for aluminum.

*Name on request

4 REYNOLDS MASTER REELS DO THE WORK OF 100 WOODEN REELS! Handle ACSR quicker, more economically. Eliminate reel inventory and exchange. Cut down on handling, storing, record-keeping—reduce damage cost to a minimum. Reynolds Master Reels and Coils are easily assembled by linemen right on the job.

For complete information

see your Reynolds distributor listed below
or write direct to Reynolds Metals Company
2584 South Third Street, Louisville 1, Kentucky.

A. A. Electric Supply, Chicago • California Electric Supply, San Francisco
General Electric Supply Co., Bridgeport (and branches) • Hendrie & Bolthoff, Denver
Hughes Electric Supply, Orlando • Maydwell & Hartzell, Inc., San Francisco
San Antonio Machine & Supply Co., San Antonio
Southern Electric Equipment Co., Atlanta • Chas. L. Ward Co., Kansas City, Mo.
Westinghouse Electric Supply Co., New York City (and branches)
Williamson Sales Co., Shreveport, Dallas and Houston

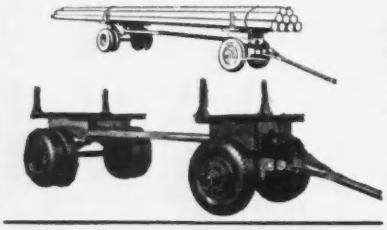
REYNOLDS ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND

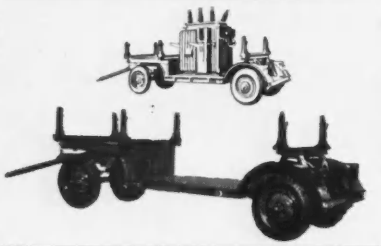
Notes on Eagle Equipment — Designed to save man-hours and money

TRAILERS

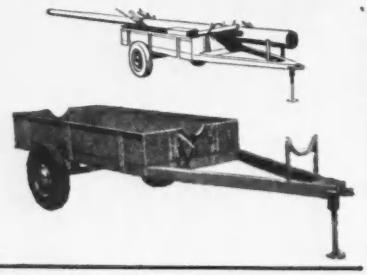
...IN A WIDE RANGE OF SIZES AND TYPES



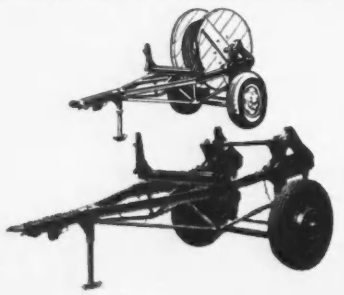
ADJUSTABLE LENGTH POLE TRAILER: easily adjusts to accommodate poles up to 90 ft. long — a big trailer that does a big job. Center pole telescopes. Trails smoothly. Equipped with electric brakes on rear wheels. Get complete information on Eagle Trailer Model 6450.



FOUR-WHEEL LO-BED TRAILER: for easy loading and hauling of heavy bulky units, also suited to pole and general purpose hauling. Five ton capacity, overall length 25 ft. 8 inches. Distance ground to low platform only 25½ inches. Equipped with electric brakes on rear wheels. Get complete information on Eagle Trailer Model 6441.



LIGHT-DUTY CARGO AND GENERAL PURPOSE TRAILER: light-duty, 1-ton capacity trailer for hauling one or two poles, cross-arms, pole hardware, etc. Has pole saddles front and rear and removable end boards. Get complete information on Eagle Trailer Model 7163.



COMBINATION CABLE REEL AND POLE TRAILER: complete with bolsters, stanchions, cable reel saddles. Quickly converted into a pole trailer by removing cable reel saddles and installing bolsters. A practical dual purpose unit, requiring only one trailer license. Get complete information on Eagle Trailer PCP — W-PCP series.

Send today for the complete catalog of Eagle Line Construction and Maintenance Equipment — a useful reference book.

EAGLE

BODIES • TRAILERS DERRICKS • TOOLS ACCESSORIES

EQUIPMENT ENGINEERED BY AND FOR UTILITY MEN EXPRESSLY FOR THEIR NEEDS

Distributed by GRAYBAR

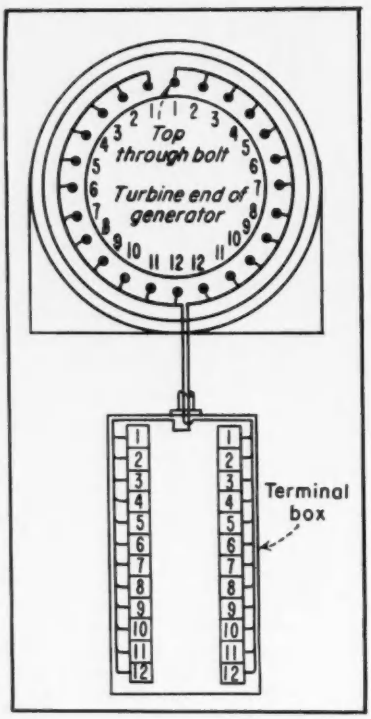
EAGLE MANUFACTURING CO., Appleton, Wis.

Division of The Four Wheel Drive Auto Co.

ductor capacity to be connected to carry 6,000 amp.

Core and windings are protected by a two-section case of ¼-in. steel, which bolts together. Steel handles or legs are welded to each corner.

Voltage applied to primary depends upon desired amperage and utilization voltage available in the field. Normally, 240-v service is used. Continuous rating of secondary is 2,000 amp. Nevertheless, in testing City Light generators at Ross power house, somewhat over 6,000 amp were obtained.



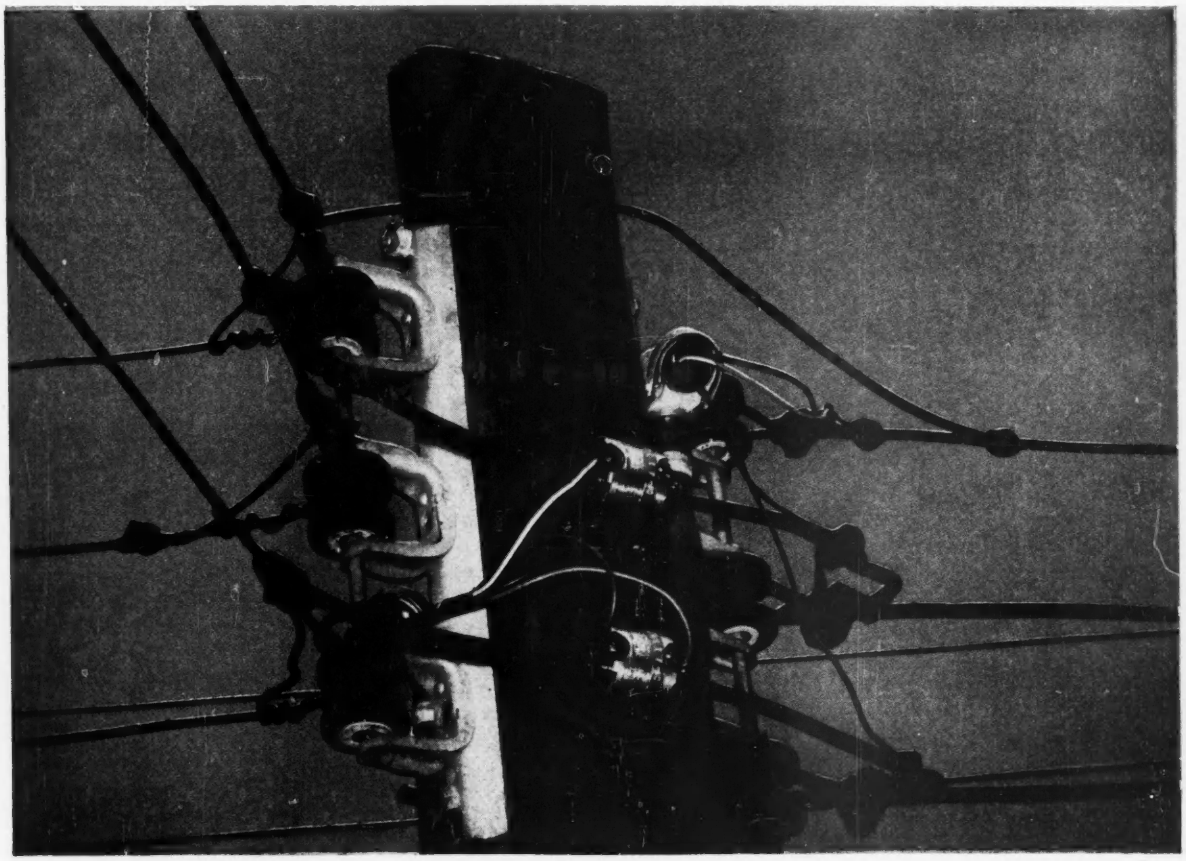
Through-Bolt Insulation Testing Simplified

C. L. BOUGHTER, Electrical Test Engineer, New York State Electric & Gas Corp, Binghamton, N. Y.

Testing through-bolt insulation, which is normally done when end bells are removed, has been simplified by New York State Electric & Gas Corp. The company has connected a 24-terminal test block, installed outside the housing of a generator at Goudey Plant, to each through bolt with insulated wire.

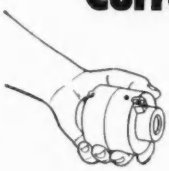
Weekly tests with a 500-v insulation test set are made and recorded by plant personnel.

Adapted from a paper presented at a recent Doble Clients Conference in Boston.



CUT INSTALLATION COSTS

with the *new* SANGAMO Type R Current Transformers



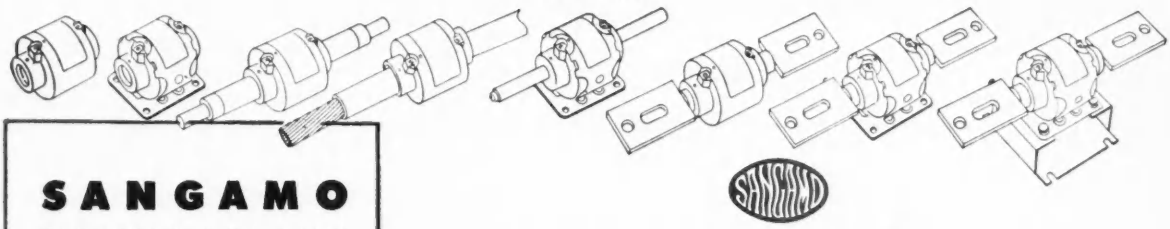
Eight variations of ONE basic transformer permit almost *any* primary arrangement.

New time and money saving installation methods are now made possible by the small size and light weight of Sangamo Type R Current Transformers.

In the installation shown above, made by a southern utility company, the base of the transformer is mounted to the pole. However, this rugged transformer is light enough so that it can also be mounted without the base by merely supporting it by the cable. Another saving is enabled by wiring secondary leads in the shop, with subsequent reduction in field installation time.

Type R Transformers are encased in a high impact phenolic shell filled with a thermo-setting plastic that eliminates voids and prevents moisture from reaching the core windings. The large opening in the Type RC-6 Transformer will admit a 250 MCM weatherproof cable in the 200 ampere rating, and 500 MCM weatherproof in the 400 ampere.

Full information is given in Bulletin 501. Be sure to get your copy.



SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Only Measured Facts are Known Facts

SM53-5

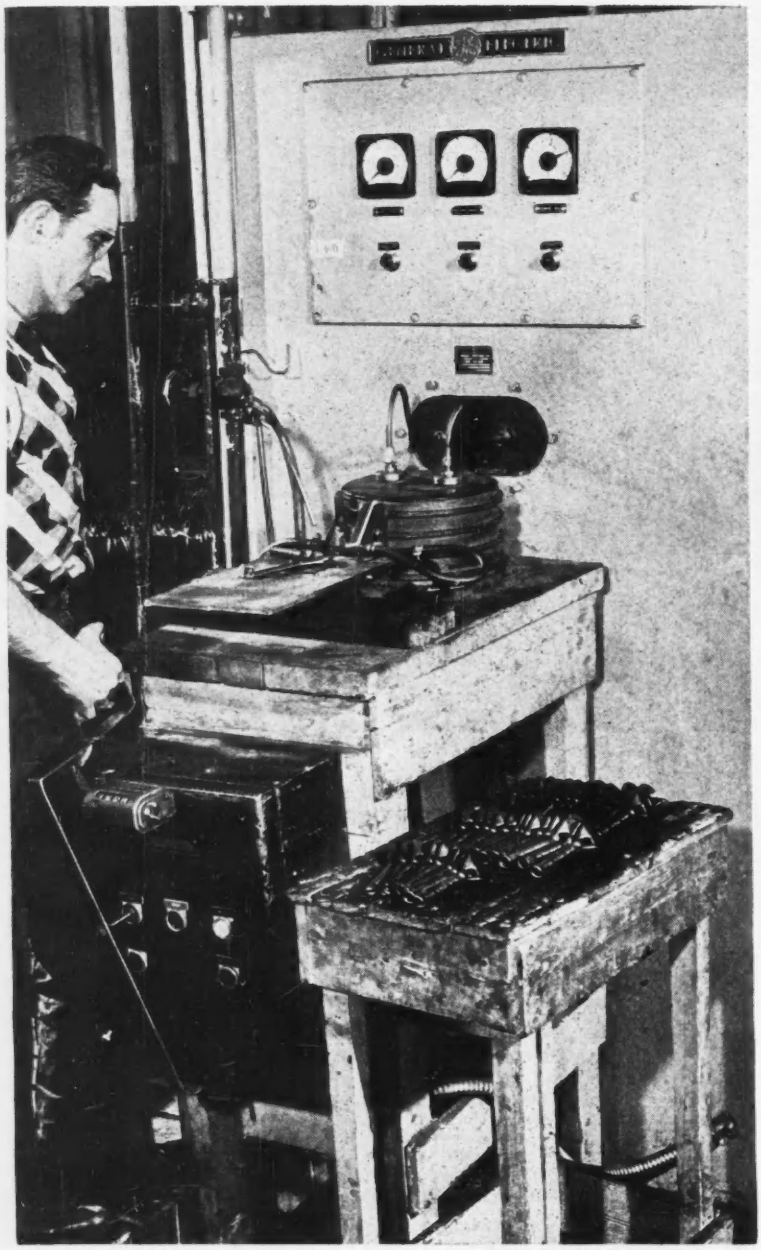


Photo Credit—General Electric Co.

Induction Heat Hardens Wrenches

Wrenches are made to last 10 times as long by heat treating working surfaces with 20-kw induction heater at Utica Drop Forge & Tool Corporation, Utica, N. Y., according to Maynard Gray, heat treating department foreman. Heater, also used to harden tips and cutting edges of pliers, treats only the area of the metal which requires some extra hardening, leaving internal structure of tools unchanged and preserving desirable toughness necessary to withstand stress and shock. One operator is able to harden 350 wrenches an hour. In each case, the tool is put on a special jig. Then it is heated, and immediately cooled by a jet of air.

Electric Water Heater Cuts Building Cost

HENRY GEROME, Industrial Sales Representative, West Penn Power Co, Pittsburgh, Pa.

An electric water heater saved the cost of a utility room and chimney in a new office building of the Wyano Foundry, Wyano, Pa. The office was to have no central heating plant and therefore needed no basement, utility room, or chimney except possibly for a water heater. By installing the electric water heater they were able to utilize idle space available in the loft.

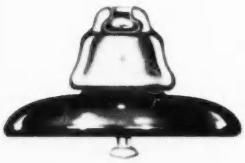
WATER HEATER installed in office building loft directly over washrooms, saves space, reduces fire hazard, and minimizes hot water drawn

The 2.5-kw heater was installed directly over the washrooms. A minimum of pipe and labor were required to extend the hot water runs. Less water is drawn off at each usage, and hot water is always instantly available for the employees and visitors of the company.

Even though papers are stored in the loft in cardboard file cases, there is no danger of fire from the electric water heater installation. In 6 yr operation, no maintenance has been required.

You Can't Do This To Insulators!

O-B Maintains Normal Service Records In One of World's Toughest Spots



Under this ice are strings of O-B suspension insulators operating at 150 kv. Location of this line crossing the Alps is so fantastically bad that men cannot patrol it in certain months -- let alone repair it! And, for ten years, it has shown an enviable operating record.

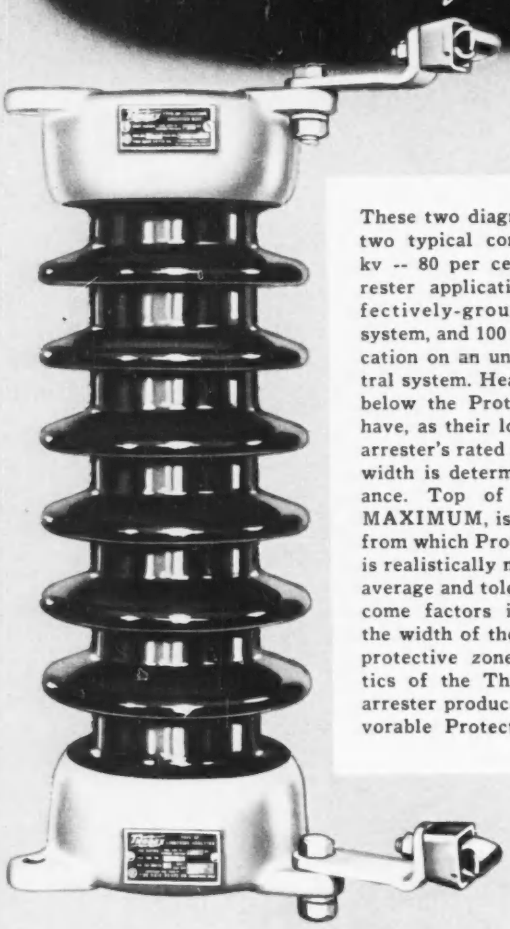
It takes a lot more than good insulators to produce such performance, but the insulators help. Here is an exacting combination of mechanical stresses; extremely heavy ice accompanied by high wind, as the ice formation clearly shows, and severe thermal loading to the insulator assembly brought about by unusually low temperatures. Yet the O-B suspension insulators with which this line is fully equipped, take all this in their stride.

Here is proof of what these insulators *can* do -- and *are doing*. It's proof of the peace of mind you will have when your lines are insulated by O-B.

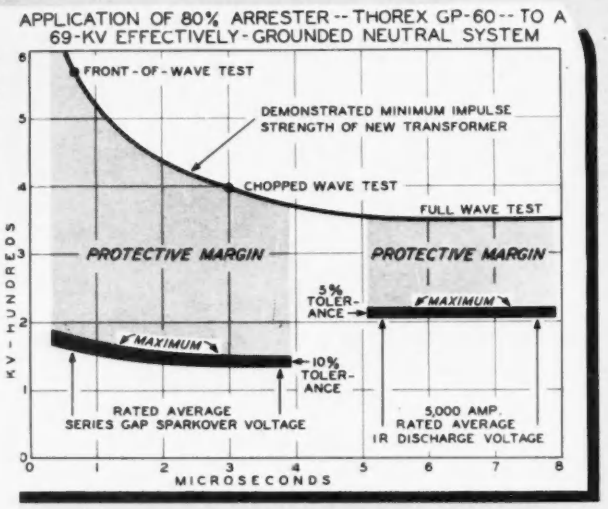
Ohio Brass

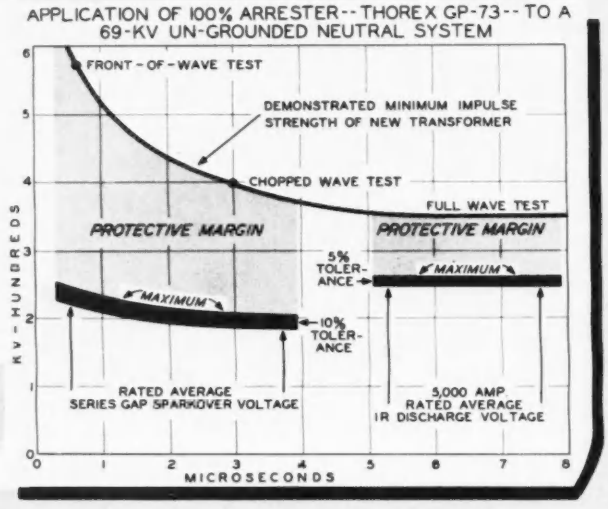
MANSFIELD, OHIO, U. S. A.

HI-TENSION NEWS *Junior*



These two diagrams illustrate two typical conditions at 69 kv -- 80 per cent Thorex arrester application on an effectively-grounded neutral system, and 100 per cent application on an ungrounded neutral system. Heavy black lines below the Protective Margin have, as their lower limit, the arrester's rated average. Their width is determined by tolerance. Top of the line, or MAXIMUM, is the only point from which Protective Margin is realistically measured. Both average and tolerance thus become factors in establishing the width of the all-important protective zone. Characteristics of the Thorex lightning arrester produce unusually favorable Protective Margins.





Biggest Dollars' Worth In Protection

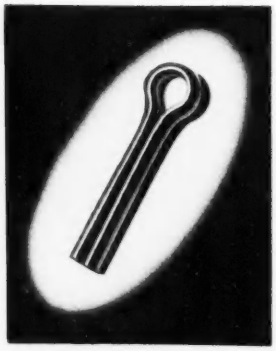
Thorex Lightning Arrester Combines Extra-Wide Apparatus Protective Margin With Low Cost

Between the basic impulse insulation strength of a transformer and the MAXIMUM performance level of a lightning arrester there is a zone in which all protection exists. Age or condition of the apparatus may invade this zone from above -- average ratings, plus protective tolerance of the arrester, invade the same zone from below. This "safety zone" or Protective Margin is all that stands between lightning and the transformer. Obviously, it should be as wide as possible.

How do the basic characteristics of a lightning arrester affect this Protective Margin? Low average arrester sparkover and IR discharge voltage ratings are, naturally, essential. But averages don't infallibly spell protection. To these averages must be added a correction factor -- tolerance. The sum of these is the MAXIMUM protective level of the arrester, which is its only significant or reliable value.

O-B Thorex GP lightning arresters start with low average ratings and add to them only +10 per cent sparkover and +5 per cent IR discharge voltage tolerances. These, as you may easily confirm, are phenominally low. This lowers the Thorex MAXIMUM point and correspondingly widens the Protective Margin.

Not for greatest protection, alone, but for greatest protection per dollar, as well, the O-B Thorex arrester is by far your best investment in protection.



How Big Is A 1-Inch Cotter Pin?

Hardware Replacement Components Are Now Described and Listed In O-B's New Number 28 Catalog

Let's assume a plain brass cotter pin that has an over-all length of 1⅜ inch and, when squeezed tightly shut, has a diameter of 5/32 inch. This is a common item in many pieces of line hardware. But, ignoring the loop, the shank portion measures only 1 inch and, since the two legs are always slightly spread, it measures $^{3}/_{16}$ inch across the end.

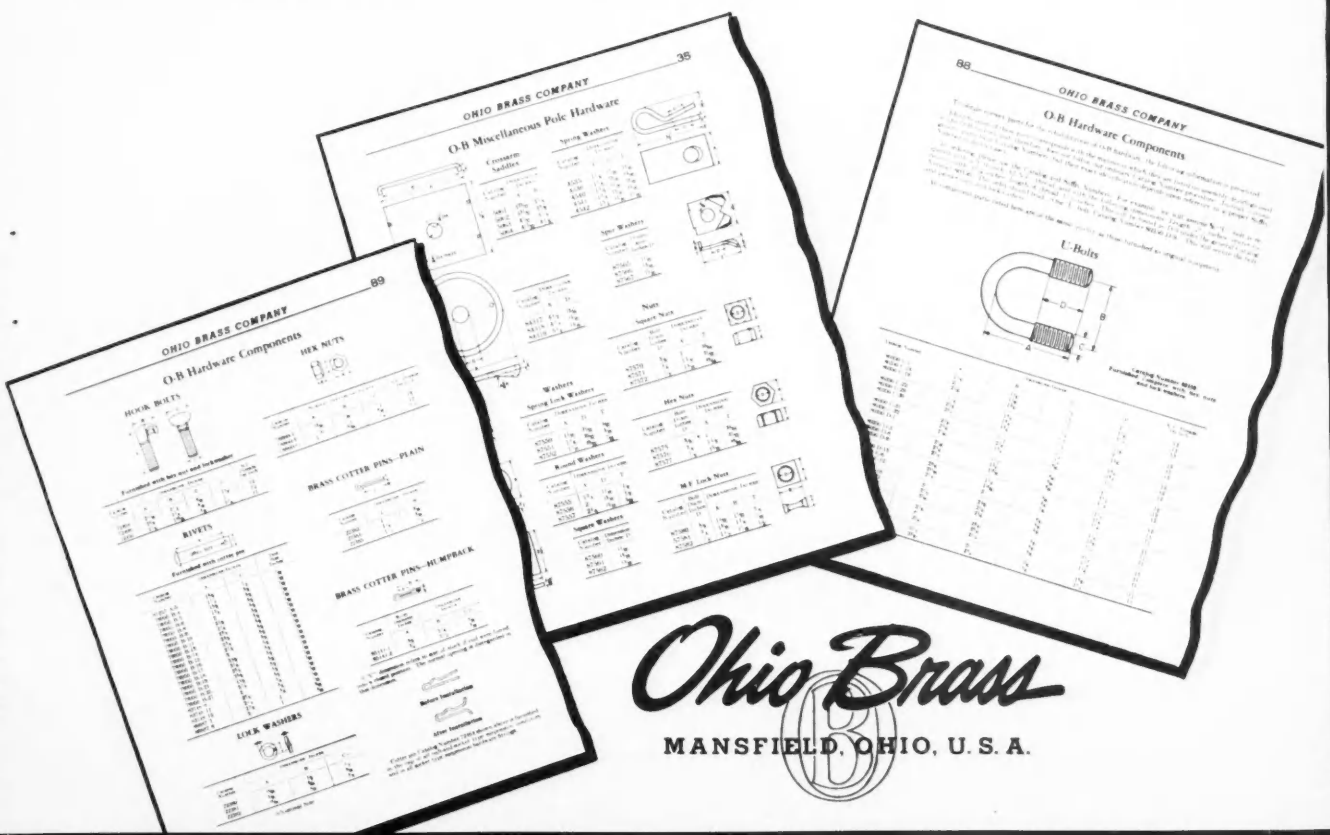
You want some of these cotter pins for replacement. What do you say on the order?

For years we have been trying to get along with this problem. Sometimes, postage and telephone calls amounted to nearly as much as the material, by the time the customer and ourselves thoroughly understood each other. In other cases, the buyer in desperation simply fastened an old piece to his purchase order and said " . . . a thousand like this."

Now you can turn to a page in the new O-B Insulator Catalog and see descriptive drawings with catalog listings covering the full range of U-bolts, hook bolts, nuts, rivets, washers, cotter pins, and all the other items required for the rehabilitation of line hardware and crossarm pins. You will be supplied with material properly adapted to the job and equal in quality to the original parts. There will be no confusion in describing your exact requirement.

We don't anticipate getting rich on this business, but we believe it will save a lot of gray hairs in Purchasing Departments, and it is indicative of O-B's effort to do an intelligent job of cataloging material.

. . . And by the way, have you seen the new Number 28 O-B Insulator Catalog?



Ohio Brass

MANSFIELD, OHIO, U. S. A.

CAUTION

...Insulator at Work!

Small "Under-Privileged" Pintype Lives the Hardest Life of Any Insulator

More than any other insulator, the small low voltage pintype must live with lightning -- and we mean the word "*live*" literally.

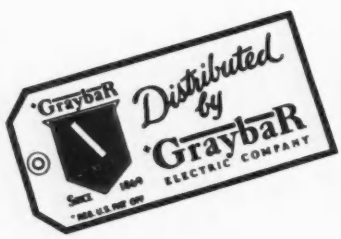
Widespread location of distribution and primary feeder lines naturally results in many cases of high lightning exposure whenever a sizable storm is over a given area. Yet, these lines seldom, if ever, enjoy even the basic lightning protection of an overhead ground wire.

Reliable statistics show that in a territory of only 30 annual storm days, lightning strokes to the conductor will average one per mile of line, per year.

Add up these facts and you will appreciate the job cut out for the small pintype. And bear in mind, since it isn't big enough to resist lightning, *it must be good enough to survive it!*

Laboratory equipment, by far the most elaborate in the insulator industry, has been concentrated on the problem of imparting high lightning survival to O-B pintype insulators. None of this painstaking research and design shows in the product -- at least not until the morning after a bad storm when you will find all your O-B pintypes still in business, and realize this performance didn't cost an extra cent.

You can build insulator trouble *out* of your distribution system by using O-B pintypes.



Ohio Brass

MANSFIELD, OHIO, U.S.A.

4396-H

SALES & SERVICE RESIDENTIAL • RURAL • COMMERCIAL

INDUSTRIAL BRIEFS

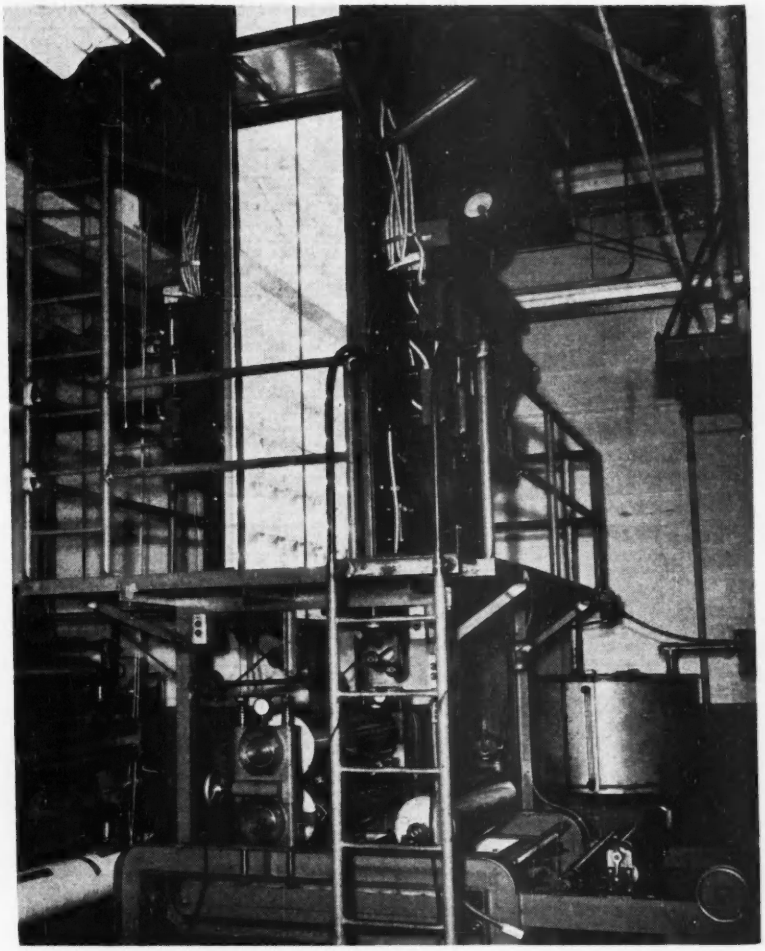
Pipe heating with 20 kw of thermostatically controlled electric heat installed in an enclosing duct on 400 ft of steam pipe at A. Stiert & Sons Broom Works, Hatfield, Pa., enables boiler to be shut down during night and still have protection against freezing. This eliminates need during cold nights of keeping a fireman on duty just to keep steam up to prevent freezing—thus saving 16 man-hours per night. Heaters operate off-peak and cost much less than night fireman's wages. K. E. Orben, Industrial Rep., Pennsylvania Power & Light Co, Bethlehem, Pa.

Wood gluing by use of 10-kw electronic glue machine at Frank F. Taylor Co, Norwood, Ohio, enables company to salvage scrap narrow pieces of poplar in making children's seats. Formerly, these pieces were burned in winter and hauled away in summer. Operation occupies ⅓ floor space as that required by hand clamp method, speeds production by using 2 men 1 shift instead of 3 shifts, and increases quality of product by making a better glue joint. F. W. Conover, Power Engineer, Cincinnati Gas & Electric Co.

Materials handling conveyor for loading box cars at American Can Co, Savannah, Ga., has eliminated use of materials handling pallets and a fork-lift truck at this rather crowded location. The cans are placed in cardboard boxes and are delivered by conveyor to loading platform where railroad cars are available. Two box cars are loaded daily in 2 hr. Formerly, 4-5 hr were required. Conveyor motor drive is 10 hp. C. D. Anderson, Power Sales Engineer, Savannah Electric Power Co.

Heating a rotating cutter with 2 - 250-w infrared lamps at Shepfer-Moomaw Bros. brick plant, Sugarcreek, Ohio, has eliminated clay sticking to cutter. Cutter is used to break up a layer of clay sheared off top of clay column as it is extruded by brick machine, in making "texture brick." This has resulted in a more uniform texture on the face of the brick, decreased attention on the part of the brick machine operator, and has minimized hazard to operator who previously cleaned the cutter manually while in operation. C. A. Merlo, Industrial Power Eng, Ohio Power Co, New Philadelphia.

Air conditioning for new section of office at the Harrison Paint & Varnish Co, Canton, Ohio, is handled most economically with a new 5 ton room conditioner located in main room with duct work to two other offices. Existing 5 ton air conditioning unit provides comfort for older office section but would not handle entire load. Customer is satisfied with results. G. W. Craiglow, Industrial Power Eng, The Ohio Power Co, Canton, Ohio.



VERTICAL TUNNEL dries paper rapidly between two infrared lamp banks. Floor space is saved and sagging eliminated

Dries Paper In 2 Min.

L. ALBERTSON—Application Engineer, Philadelphia Electric Co.

Resinous impregnated paper dries in less than 2 min while passing through an infrared tunnel at Fabricon Products Inc. of Pennsylvania, Philadelphia, Pa. After passing through bath of resin, wet sheets of paper dry as they run upward between two banks of lamps. Tunnel is 17 ft high and contains 216 1000-w lamps. Vertical arrangement saves space and eliminates sagging usually present in horizontal drying. Paper is used for cover sheets on laminated product for table and counter tops. Rapid drying is required so paper can be immediately wound for shipping or cut in sheets of selected sizes.

Calendar Co-ordinates Sales Department Operations

JANUARY

ACTIVITY	IND COOP	HOME EC	RES SERV	MDSE SECT	DISP SECT
National Awards	•	•	•	•	•
Paging The Lady		•		•	
Winners Dinner Range Contest	•				•
Winners Dinner Iowa Range	•				
Electrical Rally St Louis	•				•
Electrical Rally Iowa Division	•				
Electrical Rally Lakeside	•				
Lighting Promotion	•				
Edison Week Promotion	•			•	•
L P Gas Mailing	•				
St Louis American Cook School	•				
St Louis Recorder Cook School	•				
Res Sales Div Sales Trng	•	•	•	•	•
Kitchen Planning Contest		•			
Home Ec Tchr Workshop		•			
Clothes Dryer Sales Contest	•		•	•	•
Water Heater Sales Contest	•				
Electrical Living Show Iowa Div	•	•	•	•	•
Flameless Home			•		

FEBRUARY

ACTIVITY	IND COOP	HOME EC	RES SERV	MDSE SECT	DISP SECT
Edison Week Promotion	•				
Clothes Dryer Sales Contest	•		•	•	•
Paging The Lady		•		•	
Lighting Promotion	•	•	•	•	•
Res Sales Div Sales Trng	•	•	•	•	•
Kitchen Planning Contest		•			
L P Gas Mailing	•				
St Louis American Cook School	•	•			•
St Louis Recorder Cook School	•	•			•
Water Heater Sales Contest	•				
Electrical Living Show Iowa Div	•	•			•
Home Bildor's Show			•		
Home Ec Tchr Workshop		•			
Outlying Div Freezer School	•				
Flameless Home			•		

MARCH

ACTIVITY	IND COOP	HOME EC	RES SERV	MDSE SECT	DISP SECT
Electrical Living Show Iowa Div	•	•			•
L P Gas Mailing	•				
Paging The Lady		•		•	
Lighting Promotion			•	•	•
Kitchen Planning Contest		•			
St Louis American Cook School	•	•			•
St Louis Recorder Cook School	•	•			•
Water Heater Sales Contest	•		•	•	•
Outlying Div Freezer School	•	•			•
Home Bildor's Show			•		•
Home Ec Tchr Workshop		•			
Gift Campaign	•				
Flameless Home			•		

APRIL

ACTIVITY	IND COOP	EC HOME	RES SERV	MDSE SECT	DISP SECT
L P Gas Mailing	•				
St Louis Recorder Cook School	•	•			•
Water Heater Sales Contest	•		•	•	•
Paging The Lady		•		•	
Kitchen Planning Contest		•			
Home Ec Tchr Workshop		•			
Lighting Promotion			•	•	•
Outlying Div Freezer School	○	•			•
Gift Campaign	○			○	•
Home Freezer Sales Contest	○				
Winners Dinner W H Contest	○				
Winners Dinner W H Iowa Div	○				
Home Bildor's Show	○	○	○		○
Flameless Home			○		
St Louis American Cook School	○	○			○

MAY

ACTIVITY	IND COOP	HOME EC	RES SERV	MDSE SECT	DISP SECT
St Louis American Cook School	•	•			•
L P Gas Mailing	•				
Water Heater Sales Contest	•		•	•	
Outlying Div Freezer School	•	•			•
Home Bildor's Show	•	•	•		•
Lighting Promotion			•	•	•
Paging The Lady		•		•	
Gift Campaign	•			•	•
Kitchen Planning Cont Awards		•			
Winners Dinner W H Iowa Div	○				
Winners Dinner W H Contest	○				
Home Freezer Sales Contest	○				
Home Econ Training		•			
Flameless Home			○		

JUNE

ACTIVITY	IND COOP	HOME EC	RES SERV	MDSE SECT	DISP SECT
Outlying Div Freezer School	•	•			•
Winners Dinner W H Iowa Div	•				
Winners Dinner W H Contest	•				
Paging The Lady		•		•	
Lighting Promotion			•	•	•
Home Freezer Sales Contest	○		○		
Outlying Div Cook School	○				
Fall Electrical Rally	○				
Flameless Home			○		
National Home Week			○		
Home Econ Training		○			

JULY

ACTIVITY	IND COOP	HOME EC	RES SERV	MDSE SECT	DISP SECT
Home Freezer Sales Contest	•		•	•	•
Paging The Lady		•		•	
Lighting Promotion			•	•	•
Home Econ Training		•			
Outlying Div Cook School	○	○			○
Fall Electrical Rally	○				•
Planning 1954 Act 1954 Budget	○	○	○	○	○
Gift Campaign	○				
Flameless Home			○		○
National Home Week			○		○
Acc News Cook School	○				

AUGUST

ACTIVITY	IND COOP	HOME EC	RES SERV	MDSE SECT	DISP SECT
Home Freezer Sales Contest	•		•	•	
Paging The Lady		•		•	
Lighting Promotion	○		•	•	•
Outlying Div Cook School	•	•			○
Fall Electrical Rally	○				○
Planning 1954 Act 1954 Budget	○	○	○	○	○
Electric Range Sales Contest	○				
Acc News Cook School	○	○			○
Gift Campaign	○			○	○
National Home Week			○		○
Table Setting Contest		○			
Flameless Home	○	○	○		○

SEPTEMBER

ACTIVITY	IND COOP	HOME EC	RES SERV	MDSE SECT	DISP SECT
Outlying Div Cook School	•	•	•		•
Fall Electrical Rally	•				•
Planning 1954 Act 1954 Budget	•	•	•	•	•
Paging The Lady		•		•	
Lighting Promotion	•		•	•	•
Flameless Home	•	•	•		•
National Home Week			•		•
Electric Range Sales Contest	○		○	○	○
Acc News Cook School	○	○			○
Gift Campaign	○			○	○
Table Setting Contest		•			•
Home Ec Tchr Workshop		○			
Winners Dinner Range Contest	○				

OCTOBER

ACTIVITY	IND COOP	HOME EC	RES SERV	MDSE SECT	DISP SECT
Outlying Div Cook School	•	•	•		•
Electric Range Sales Contest	•		•	•	•
Acc News Cook School	•	•			•
Gift Campaign	•			•	•
Paging The Lady		•		•	
Lighting Promotion	•		•	•	•
Flameless Home			•		
Table Setting Contest		•			•
Clothes Dryer Sales Contest	○				
Winners Dinner Range Contest	○				
Winners Dinner Iowa Range	○				
Home Ec Tchr Workshop		○			

NOVEMBER

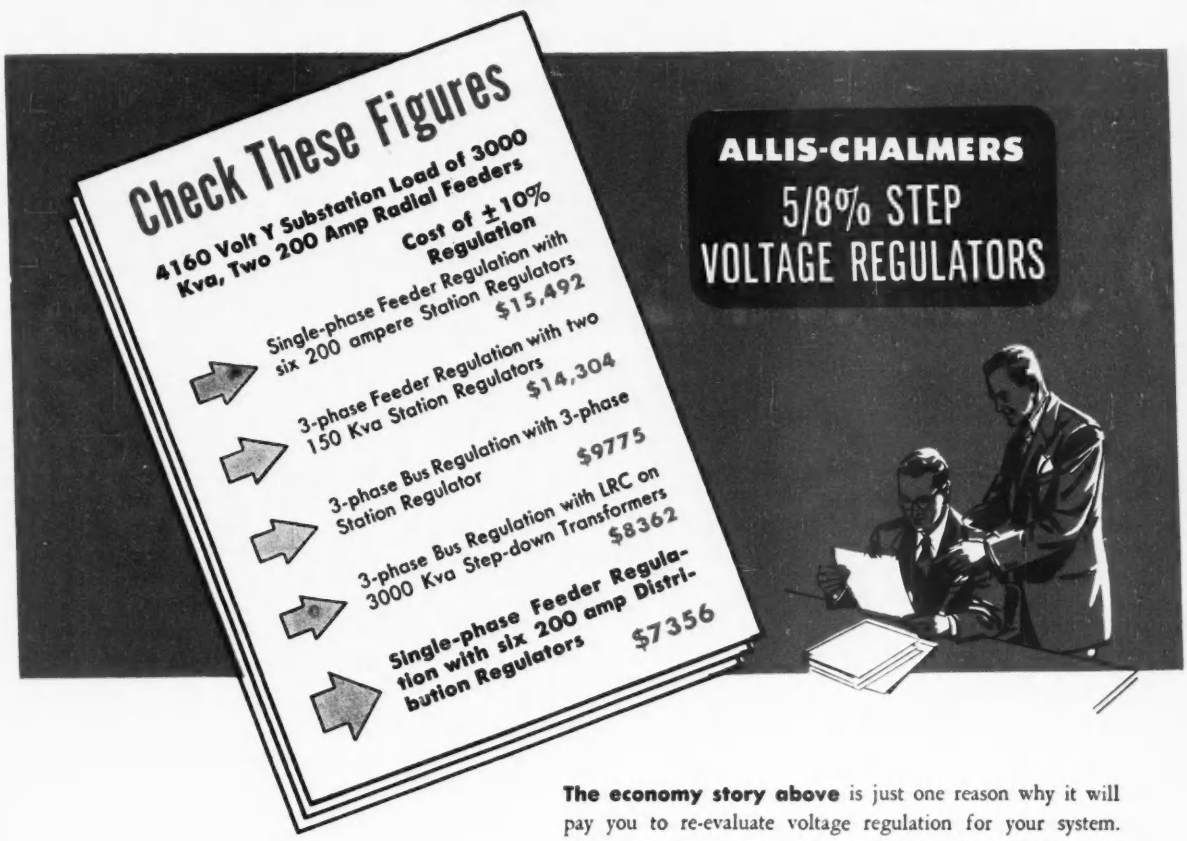
ACTIVITY	IND COOP	HOME EC	RES SERV	MDSE SECT	DISP SECT
Outlying Div Cook School	•	•	•		•
Electric Range Sales Contest	•		•	•	
Gift Campaign	•			•	•
Paging The Lady		•		•	
Home Ec Tchr Workshop		•			•
Lighting Promotion			•	•	•
Flameless Home			•		
Clothes Dryer Sales Contest	○				
Winners Dinner Range Contest	○				
Winners Dinner Iowa Range	○				
Electrical Rally St Louis	○				
Electrical Rally Iowa Division	○				
Electrical Rally Lakeside	○				
Edison Week Promotion	○				
L P Gas Mailing	•				
Kitchen Planning Contest		•			
National Awards		•	•	•	•

DECEMBER

ACTIVITY	IND COOP	HOME EC	RES SERV	MDSE SECT	DISP SECT
Gift Campaign	•			•	•
Paging The Lady		•		•	
Lighting Promotion			•	•	•
Clothes Dryer Sales Contest	○		○	○	•
Winners Dinner Range Contest	○				○
Winners Dinner Iowa Range	○				
Electrical Rally St Louis	○				
Electrical Rally Iowa Division	○				
Electrical Rally Lakeside	○				
Edison Week Promotion	○				
L P Gas Mailing	○				
National Awards	•	○	•	○	•
Kitchen Planning Contest		•			

Preparation and performance of sales operations are scheduled for the year by Union Electric of Missouri. Details on page 122

Comparison Proves You Can Reduce Regulation Costs


Check These Figures
4160 Volt Y Substation Load of 3000 Kva, Two 200 Amp Radial Feeders
Cost of ±10% Regulation
Single-phase Feeder Regulation with six 200 ampere Station Regulators $15,492
3-phase Feeder Regulation with two 150 Kva Station Regulators $14,304
3-phase Bus Regulation with 3-phase Station Regulator $9775
3-phase Bus Regulation with LRC on 3000 Kva Step-down Transformers $8362
Single-phase Feeder Regulation with six 200 amp Distribution Regulators $7356
ALLIS-CHALMERS
5/8% STEP VOLTAGE REGULATORS

This Single Example Shows How You Save At Least $1006.00

Over Previous Lowest Cost Equipment

The economy story above is just one reason why it will pay you to re-evaluate voltage regulation for your system. Changes in system economics brought about by Allis-Chalmers distribution regulators may add up to better regulation and lower costs.

In many cases you can now bring the advantages of individual phase regulation to every feeder in a system. Both utility and consumer benefit. You get ± 1 volt accuracy, 20% range of regulation. You can increase revenue — and profits.

Get High Quality Regulation

Allis-Chalmers distribution regulators bring you all the advantages of 20 years of regulator progress. You can get more facts on these low-cost, reliable units — plus a set of six cost comparison charts to help analyze your system — by calling your nearby A-C district office or writing Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4044

ALLIS-CHALMERS

Originators of 5/8% Step Regulation

Sales Operations Calendar

(*Story begins on page* 120)

Who is responsible when for planning and doing in the sales operations of the Union Electric Co of Missouri is set down clearly for all concerned to see in a calendar of activities. The 12 sheets of the calendar are assembled in a stiff-cover binder 10 in. by 12 in. in size. Copies are distributed throughout the department and to others in the company interested.

As shown in chart on page 120, activities are listed in the months of preparation and performance. Preparation is indicated by an open circle in the column or columns of the department sections responsible, and carrying on the activity by a black dot. For instance, getting ready for the "Edison Week Promotion" is the joint responsibility of the industry co-operation, merchandise and display sections in January, then in February the industry co-operation section stages the activity.

The calendar shows what each department section is doing and is scheduled to do at any time. With preparation and performance thus programmed through the year, there is avoided that last minute rush which results from the realization that an activity scheduled for this month should have been, but was not, prepared last month.

EEI Prepares Sales Campaign Schedule

A coordinated campaign calendar for the promotion of seven major electrical appliances in 1954 has been released by the Dealer Coordination Committee of Edison Electric Institute. Based on replies to a survey of the electric utilities, the calendar lists the months during which the companies indicated they would promote ranges, water heaters, dryers, freezers, dishwasher-disposals, air conditioners, and dehumidifiers.

First campaign calendar was released by the committee last year and proved helpful in coordinating the schedule of promotional programs by manufacturers, distributors, dealers, leagues, and utilities. Purpose of the calendar is to concentrate the promotional and advertising activities of the entire industry during certain designated periods to increase effectiveness of individual local campaigns.

General Electric

BRIGHTENED night-time shopping view shows why Oakwood, Ohio is . . .

Lighting Main St. with Fluorescents

H. NONNEMAN, Dayton Power & Light Co, Dayton, Ohio

Last December the city of Oakwood, Ohio, switched on 52 new fluorescent street lights—one of the largest single installations of such lighting in the United States. City officials chose fluorescents for two reasons:

- To counter-balance the lure of shopping districts in nearby Dayton and other large cities, and stimulate after-dark activity in its own downtown section.
- To make its main street—part of a state route heavily traveled by autos, trucks, and buses—safer.

The city decided that the 6-ft, fluorescents would solve the safety problem because of these characteristics:

1. They are virtually glare-free, with light emission area being about four to five times that of equivalent filament or mercury fixtures.
2. They lessen glare on wet pavement and make objects on the road more easily seen in silhouette.
3. They increase output as the temperature falls (unlike conventional fluorescents), thus providing more light during hazardous winter season nights.

Installation Described . . . The installation extends over eight blocks, two in an adjoining township. The units are mounted at a height of 30 ft on steel standards spaced at 95 ft along the 4-ft wide median strip.

Arrangement results in an initial average illumination level of 1.7 ft-c. The wide Type 1 pattern of the luminaires, plus their maximum candlepower angle of 70 deg makes the unit especially suited to the relatively close spacing and positioning which usually prevails in business districts.

It is estimated that the indicated illumination level of 1.7 ft-c affords an overall visibility equivalent to a level of from 2 to 3 ft-c provided by conventional luminaires with concentrated light sources.

Each luminaire accommodates four T-12, 72-in., rapid-start fluorescent lamps, which generate from 20,000 to 25,000 lumens, depending upon ambient temperature. Only one internally mounted ballast is used per luminaire, and the ballast and four lamps consume about 250 w and require constant current transformer capacity of 1 kw. The complete system is supplied by two separate series circuits.

City officials predict that because of the new lighting existing businesses will be expanded and many new shops will be attracted. In addition to improving overall property appearance, this will raise the income the city derives from taxes, which will more than offset cost of the luminaires.

IT TAKES MORE THAN THIS HAMMER BLOW TO INJURE—

VICTOR PURIFIED PORCELAIN!

See that hammer falling? It's about to strike the outer edge of a Victor Suspension Insulator with a blow that *greatly exceeds specifications!* This is routine control procedure in Victor's test laboratories. It proves that insulators made of *Purified Porcelain* consistently withstand impacts in excess of NEMA standards. This finest porcelain ever made is more dense, harder, tougher and far more resistant to impact than any other porcelain yet developed. For full data on Victor Suspension Insulators, write for Bulletin No. 4.

Victor No. 900, 10" Suspension Insulator being subjected to impact test in Victor's Test Laboratories.

FREE BOOKLET gives you the full story on how Victor insulators are made—how and why *Purified Porcelain* was developed. Write us for your copy.

VICTOR NO. 900 SUSPENSION

Specify VICTOR INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators • Custom Designed Insulators

NEW EQUIPMENT

Ground Meter

Type W4 Groundometer is a null reading Wheatstone bridge for measuring ground resistance of driven ground rods and grounding systems. It has nine full scale ranges from one to 10,000 ohms and is powered by six, self-contained, flashlight cells. Reference rods and test leads are carried in a compartment in the portable carrying case.

The meter can also be used as a dc bridge from 0.01 to 100,000 ohms at 0.1% accuracy by connecting an exterior galvanometer. Complete unit is 7½ x 7½ x 12 in. and weighs 16 lb.

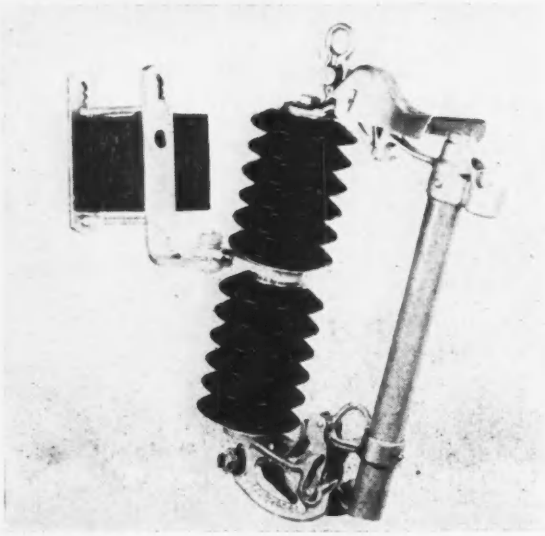
Borden Engineering Co, New Providence, N. J.

Bushing Connector

Designed for use with either aluminum or copper conductors, the high-voltage tank-wall bushing connector features a stainless-steel followup spring. Built with a large serrated bearing surface, which grips the wire and breaks down aluminum oxide, the spring is said to maintain a tight connection even when coldflow occurs.

Copper-alloy components are tin plated. Bi-metal adapters are recommended where salt or chemical fumes are severe.

General Electric Co, Schenectady 5, N. Y.



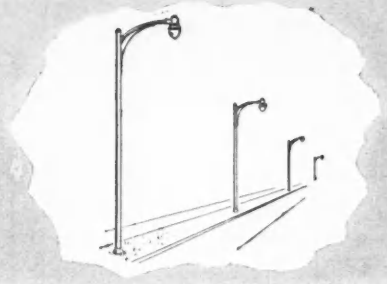
Cutout

Type CV-33-D features the principle of controlled venting that allows gases generated on heavy faults to escape at both ends of fuse tube. On moderate faults expulsion gases vent at the lower end of tube only.

It is available in 5, 7.5, 15, and 17-kv ratings with continuous current at 100 and 200 amp. Interrupting ratings are 2,500 and 4,000 rms amp. Universal button-head fuse links are used.

Southern States Equipment Corp, Hampton, Ga.

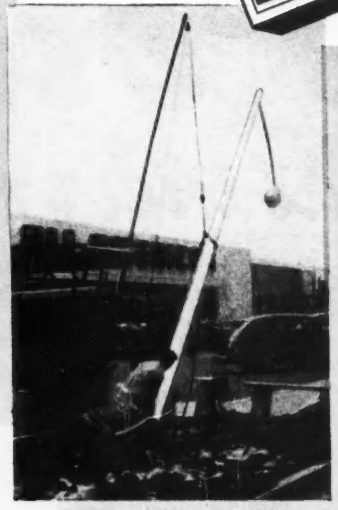
Installation Easy As



A Aluminum Alloy Standards are light, strong, easy to handle.

B Bracket and luminaire are attached before raising.

C Complete installation takes only a few minutes.



HAPCO

Aluminum Alloy Standards and Brackets

HAPCO Standards weigh less than half their counterparts in steel. The photographs above show the installation of a 30-foot Standard complete with 8-foot Bracket and large Luminaire; easily handled with small truck, light block and tackle and a minimum crew. A glance at the pictures tells the story.

One user reports that a four man crew was able to erect more than twice the number of HAPCO Standards that they had normally installed when using steel. This was entirely due to the light weight of the HAPCO poles even though complete with Brackets and Luminaires.

A saving of more than 50% in time is a vital consideration for every erection crew. Further suggestions in time and money saving features will be furnished by our engineers on request.

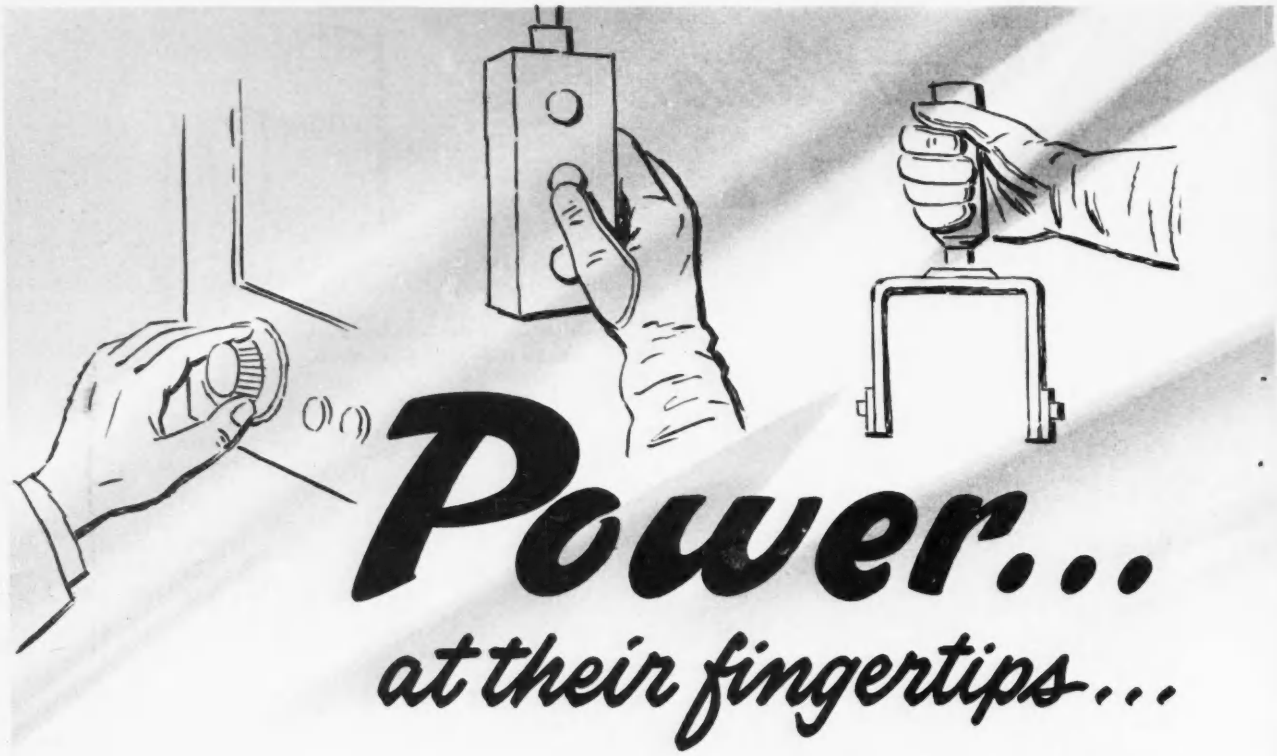
Write for literature on Standards and Brackets

HUBBARD ALUMINUM PRODUCTS COMPANY

MANUFACTURERS OF HAPCO QUALITY ALUMINUM PRODUCTS

A Division of HUBBARD and COMPANY

6301 Butler Street • Pittsburgh 1, Pa.



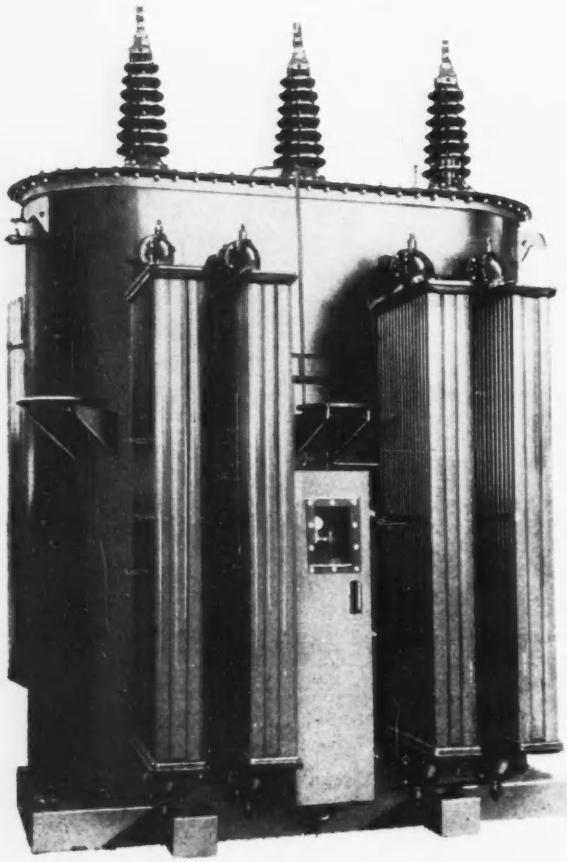
Power... at their fingertips...

Industries, commercial establishments, whole families all depend on reliable electric power as a motivating force for good production, effective lighting and essential home comforts.

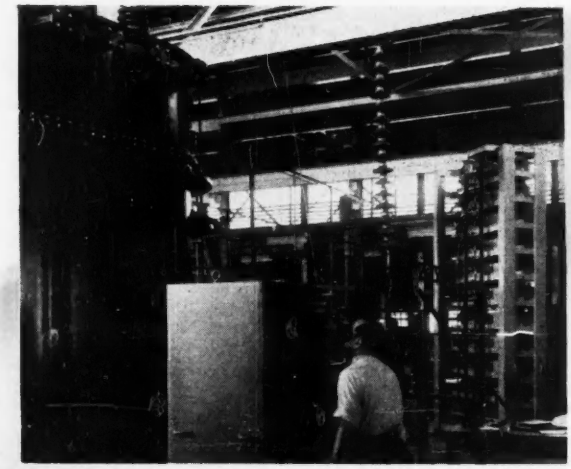
For 36 years Standard Transformer engineers, working with utility company engineers, have designed and manufactured better transformers for more efficient use and dependable channeling of electric power. Service records, dating years back, prove the dependability; the economy; the low maintenance cost of STANDARD Power Transformers.

STANDARD Power Transformers are embodied with compactness of design, inherent strength and exceptional stability. Manufactured with extreme care, STANDARD Power Transformers are built to your specifications. STANDARD engineers, working with your engineers, arrive at the best construction and design for your particular needs. Normal loads . . . and overloads can be handled again and again whenever emergencies arise.

There's a Standard Transformer representative near you. Call him. Have him help you with your power transformer installation.

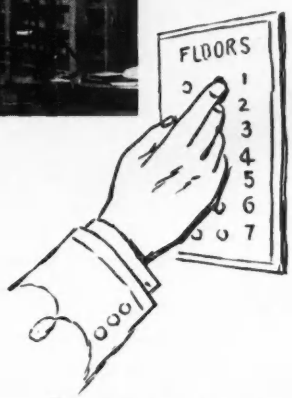


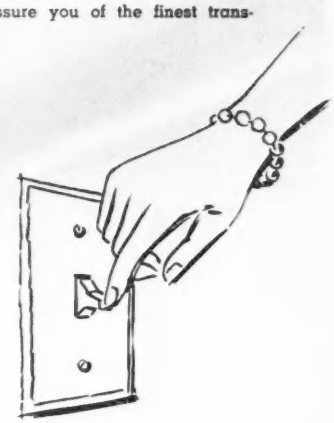
STANDARD Type AT, OISC Power Transformer, 7500 KVA, three-phase, 60-cycle, 66,000 to 13,800 volts, gas-seal construction, equipped with lightning arrester mountings and arranged for addition of forced air cooling.



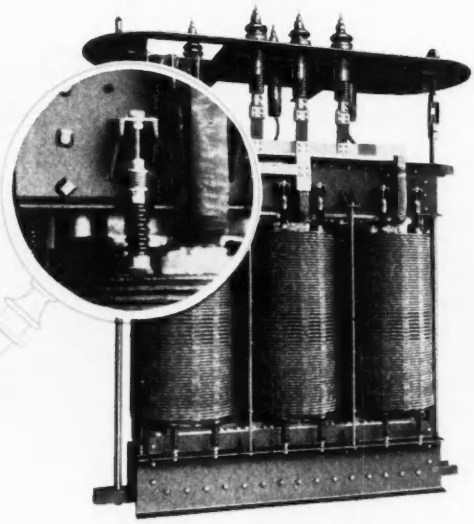
TESTING

This man is impulse testing a large Power Transformer in STANDARD'S modern plant at Warren, Ohio. A surge generator, with a range of one million volts, is used for ASA and NEMA standard and front-of-wave-impulse tests. Each transformer, no matter what the size, is subjected to standard commercial tests—both during manufacture and at completion. Experienced, thorough testing and inspection assure you of the finest transformer performance.



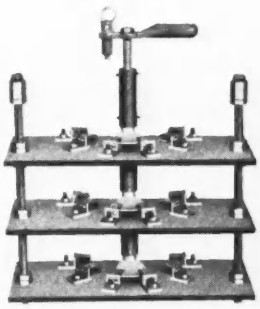


PUT THERE BY *Standard* TRADE MARK POWER TRANSFORMERS



TAP CHANGER

STANDARD'S specially designed three-deck tap changer switch is externally operated without excitation. It also has positive contact with wiping action which has proven dependable for many years. Normal settings are with a 4-tap voltage selection . . 2½% taps within 10% range of normal rating. STANDARD supplies transformers with 4 taps above or below, or half above and half below as specified by the customer at no extra cost. Contact-making points are submerged in oil.



CORE AND COIL ASSEMBLY

This view shows the low voltage side of the core and coil assembly of a Power Transformer. Note STANDARD'S special design spring bracing with compression-type porcelain insulators on high voltage coils to compensate for the movement of coils during short circuit. It also compensates for shrinkage of the coil in operation.

THE STANDARD TRANSFORMER COMPANY

Trade Mark ®

WARREN, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

Another Load of:

Haley's

CEDAR POLES

and

FIR CROSS ARMS

Light in weight and clean. PENTAchlorophenol treated in our modern plant for protection against decay, moisture and insect damage.

TWO strategically located yards:

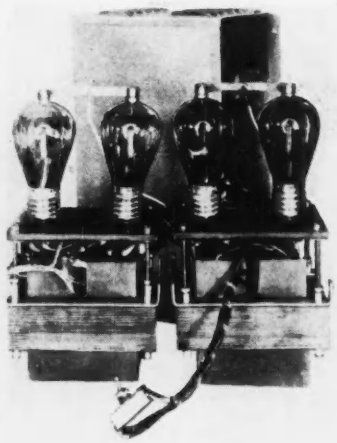
MINNEAPOLIS, MINNESOTA

FINDLAY, OHIO

R. G. HALEY & CO.

SPITZER BLDG.

TOLEDO 4, OHIO



Rectifier

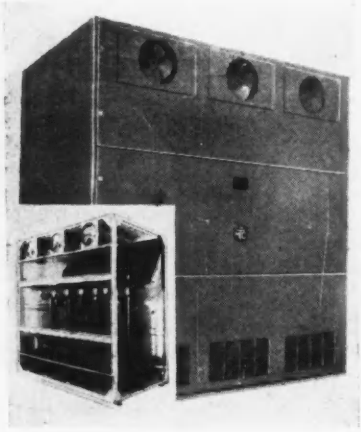
Two rectifying units in one, sheet steel, hammerloid finished cabinet are available with integral switching. Closing a switch cuts in a second rectifier to supply additional loads. Unit is 17 x 15 x 5½ in. and has current ranges of 2 to 10 amp for operating magnetic chucks and small dc motors.

Electronic Rectifier Co, Rochester, N. Y.

Electric Furnaces

Called Dyna-Kiln, the electric furnaces, comprising a line of 37, are available in 2,050 F and 2,300 F heat ranges, and feature Dyna-Glow heating elements. These elements are said to assure even temperatures without protrusion of elements into the furnace interior.

L & L Manufacturing Co, Chester 43, Pa.



Transformer

Available in ratings from 100 to 3,000 kva and voltages to 15,000 v, the dry-type transformers have two ratings. Double rating results from blowers mounted in the housing and a thermostat in the transformer coils. An increase in transformer rating of 33.3% is said to result when fans are operating.

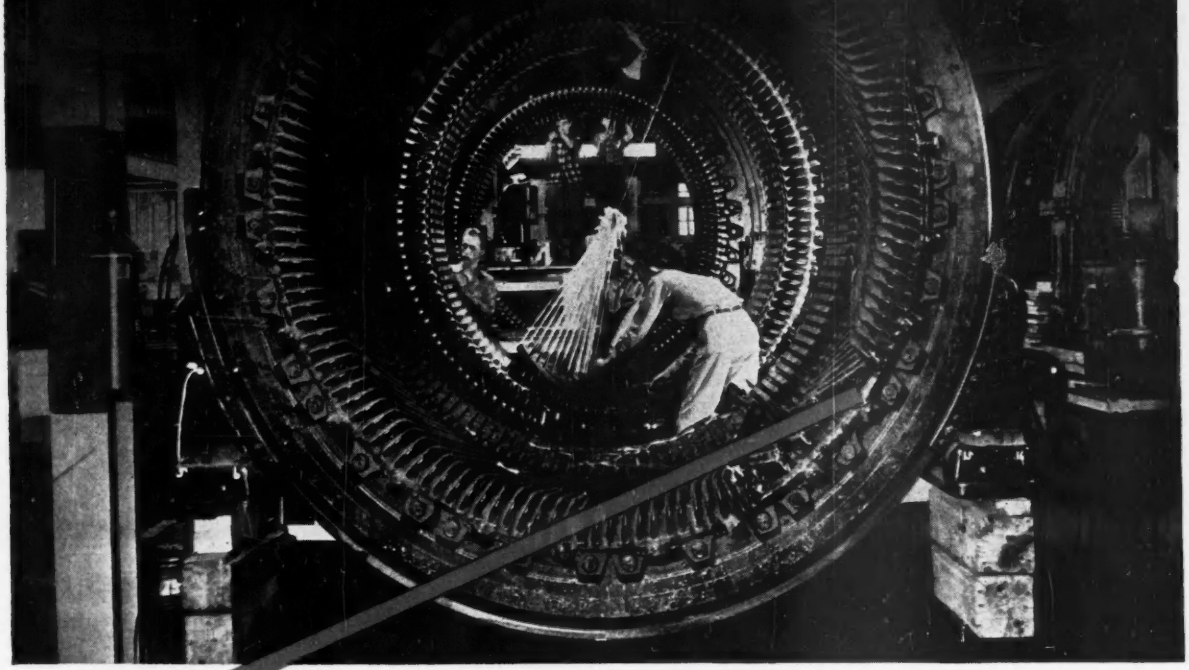
Marcus Transformer Co, Hillside, N. J.

Lighting Fixture

For explosion proof uses, the redesigned fixture is said to have improved threaded connection to prevent liquid, vapors or dirt from entering bulb and receptacle areas. Other features include notches in the hood and globe holder to enable loosening the latter with a screw driven, and a thumb screw set between the notches to lock the holder in place.

Crouse-Hinds Co, Syracuse 10, N. Y.

THE PROBLEM: changes in line voltage characteristics of synchronous converters



National has the answer

National engineers weren't stumped when a customer needed increased voltage from four synchronous converters. National redesign, made effective by National rewinding and National insulating materials, produced the required increase without loss of capacity.

In answer to another synchronous converter problem, National engineers proposed substantial voltage reductions which resulted in a 26% increase in the capacity of the National-rebuilt sets.

National engineers can redesign your apparatus to enable it to meet changing requirements. National craftsmen, working with National materials, can handle any rewinding job. National field engineers will supervise on-the-spot rebuilding of equipment too big to ship.

If you have a problem with any piece of rotating electrical equipment, it will pay you to consult National.

Wherever you are our nearby Field Engineer is available

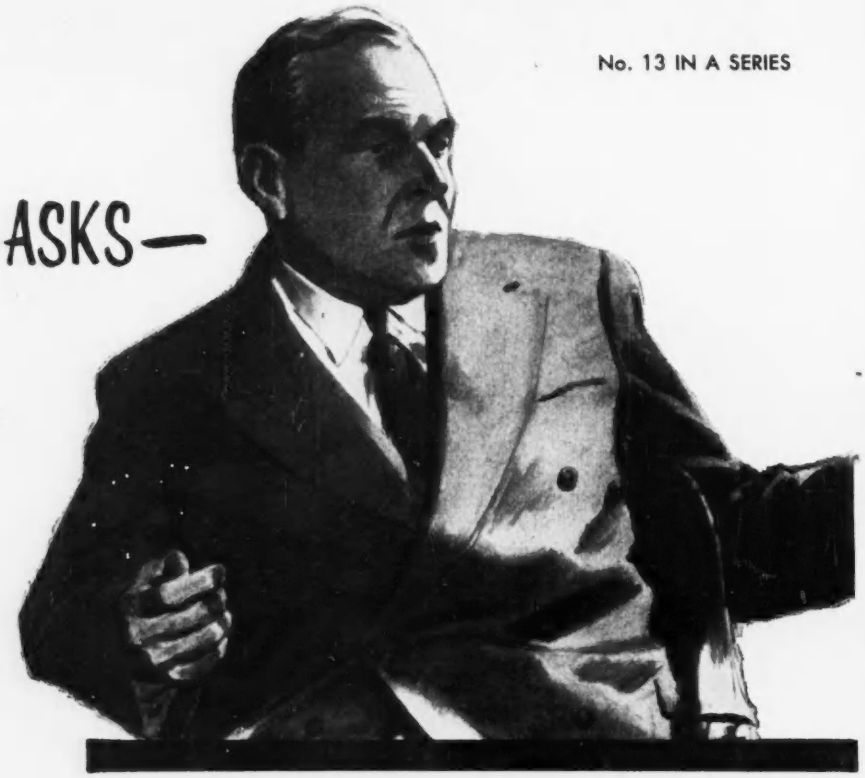
NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

No. 13 IN A SERIES

A Line Engineer ASKS—



"how can we eliminate television interference originating from our lines?"

HERE'S OUR ANSWER:

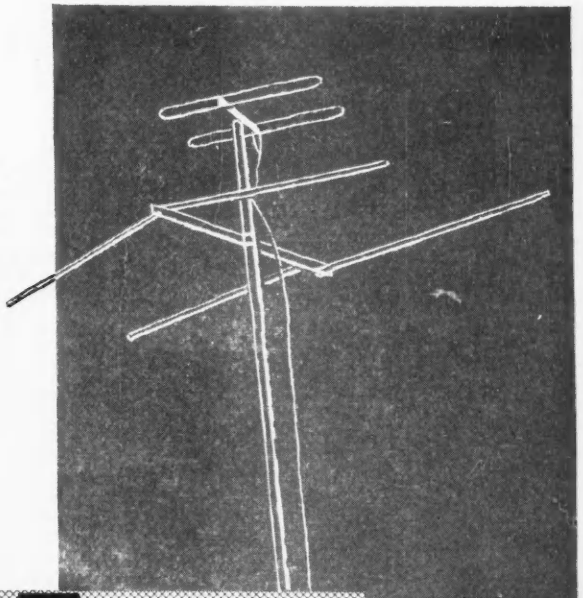
Surveys prove that only 10 to 15% of the TV interference complaints are traceable to utility equipment. To eliminate one source of potential trouble, install PINCO "NOCORONA" Units when you build new lines or replace standard pin type insulators on your present lines. By doing so, Radio and TV interference caused at the point of insulation is automatically reduced to *zero*.

What Makes a Pinco Insulator "Corona-Free"?

PINCO "NOCORONA" units embody all of the rugged design features of standard Pinco Pin-Type Insulators, *plus* the application of a special glaze at the critical points . . . the conductor and tie wire grooves. This glaze, being conducting, forms an intimate bond between the conductor, tie wire and insulator, thus eliminating the possibility of brush discharge (Corona) from the conductor and tie wire to the insulator.

Suspension Insulators . . . Clamps and Fittings . . . Switch and Bus Insulators . . .

PINCO introduced its "NOCORONA" units in 1929 whereupon they immediately proved to be an effective means of eliminating interference previously caused by Corona discharge. That was twenty-four years ago! Today, thousands of PINCO "NOCORONA" Insulators are in service from coast-to-coast insuring "interference-free" reception for millions of radio listeners and television viewers.



FOR COMPLETE INFORMATION *regarding Pinco Pin Type Insulators ("NOCORONA" and Standard Types) refer to Pinco Catalog No. 49, page 28 to 43 . . . or contact the Joslyn office in your locality.*

The Porcelain Insulator Corporation
LIMA, N.Y.

PINCO INSULATORS

Distribution and High Voltage Pin Types . . . Guy and Tree Insulators . . . Special Porcelain.

RIGHT ON THE JOB

(*Advertisement*)

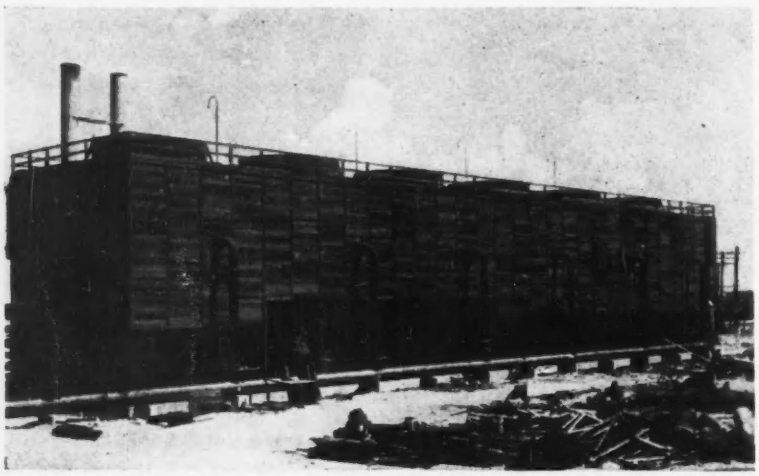
INDUSTRY NEWS IN BRIEF . . .

ONE DROP OF WATER IS THE TARGET OF ENGINEERS AT SANTA FE TANK & TOWER COMPANY

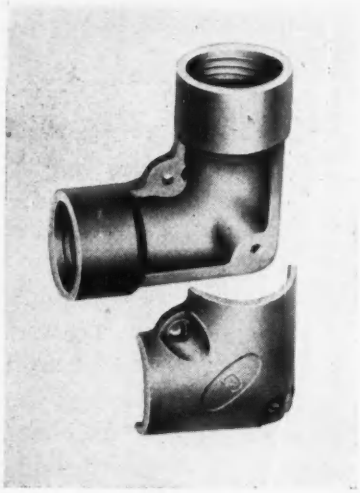
To the engineer who designs a cooling tower, *one drop* of water is more than just "a drop in the bucket." He attaches a lot of importance to it . . . because his job is to concentrate on producing a maximum rate of *heat dissipation* from *each* drop of water that is to pass through the cooling tower. Multiplied many times, of course, the single drop of water effects the over-all efficiency of the tower.

The Santa Fe Tank & Tower Company, Los Angeles, has utilized a highly successful engineering formula for properly *balancing* each drop of water in relation to the exact ratio of air required to cool it. This formula has resulted in a high degree of operating *efficiency*.

The Santa Fe *pattern* for cooling tower design also includes a new method of deck design and deck spacing that exposes each *drop* of water to the air for a longer period of time without decreasing the free flow of air through the tower. This "prolonged" air-water contact has proven to be an important *efficiency* factor.



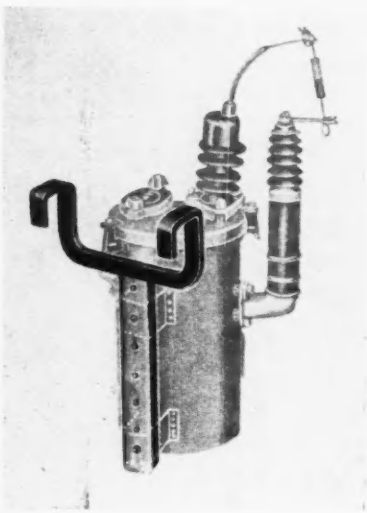
The cooling tower shown here is a 6 cell Mechanical Draft unit installed at an oil refinery where gasoline and petroleum by-products are processed. Additional information is available. Write to Santa Fe Tank & Tower Company, 5401 S. Boyle Ave., Los Angeles 58, California. Data is also available on Wood Pipe, Wood Tanks, Gas Scrubbers and other industrial wood specialties. Santa Fe maintains branch offices in all principal cities.



Conduit Elbows

Available in 1¼, 1½, and 2-in. sizes, the conduit elbows are designed for space saving machine wiring, it is claimed. They are made of malleable iron, cadmium plated, and accurately machined.

Gedney Electric Co, New York, N. Y.

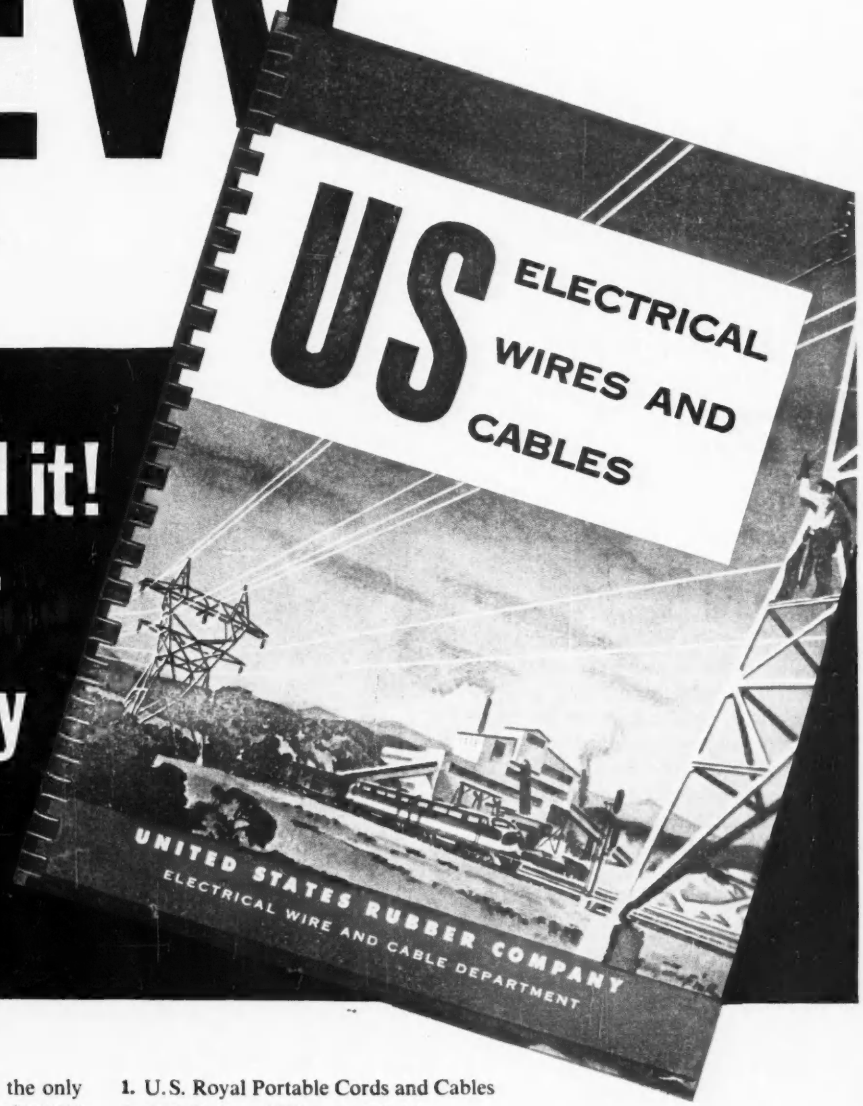


Hangers

Crossarm hangers are formed from heavy gauge steel and hot-dip galvanized. They are available in two sizes: Model T-1 weighs 16½ lb, and is applicable for single-phase transformers up to 15 kva and three-phase units of 9 kva. Model T-2 weighs 37¼ lb, and is applicable for single-phase transformers up to 50 kva and three-phase units of 45 kva. Hanger kickers are also available.

Thiel Tool and Engineering Co, St. Louis, Mo.

NEW



You need it! Send for free copy today!

United States Rubber Company, the only electrical wire and cable producer to grow its own natural rubber and to manufacture its own plastics and synthetic rubber, makes a complete line of electrical wires and cables for every industrial and domestic application. Just published is the 1953 "U.S." Catalog, essential for men who specify, install or maintain electrical wire and cable. Send for your free copy to address below. Here are the catalog chapter headings:

1. U.S. Royal Portable Cords and Cables
2. U.S. Railroad Wires and Cables
3. U.S. Power Cables
4. U.S. Control and Signal Cables
5. U.S. Building Wires and Cables
6. U.S. Bare and Weatherproof Wires
7. U.S. Flexible Cords and Cord Sets
8. U.S. Telephone Wires and Cables
9. Miscellaneous U.S. Wires and Cables
10. Technical Data

"U.S." Research perfects it...

"U.S." Production builds it

U.S. RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE AND CABLE DEPARTMENT · Rockefeller Center, New York 20, N. Y.

Airport Light

Thermal Beam, approved under CAA Spec. L-818, is said to feature 200,000-cp intensity, low installation cost, low maintenance cost, simple tower control, low mounting height, no color filters required, new beam control principle, simplified lens replacement, reserve capacity for emergencies, and corrosion proof.

It is based on the idea that for maximum visibility there must be an increase in both intensity and coning simultaneously. These are controlled from the control tower.

Line Material Co, Milwaukee 1, Wis.

Control Panel

For automatic heating and power equipment, the control panel is designed to guarantee proper mounting and wiring for commercial and industrial controls, regardless of fuel used. Panels are supplied in standard assemblies for most frequently used controls, which operate from a 230-v, 60-cps supply.

Controls, switches, instruments, and gauges are mounted, wired, and tested at the factory. A terminal strip provides connection to burner-mounted controls.

Iron Fireman Manufacturing Co, Cleveland 11, Ohio

Phase Changer

Motor-X is a device for operating a three-phase squirrel cage induction motor from a single-phase power supply. Standard units, available in 1- to 10-hp ratings, operate a 220-v, 60-cps, three-phase motor.

Class I units are for use with motors that start unloaded. Class II units develop approximately 200% starting torque at about 15% higher starting current than Class I units. Both units develop approximately 200% breakdown torque.

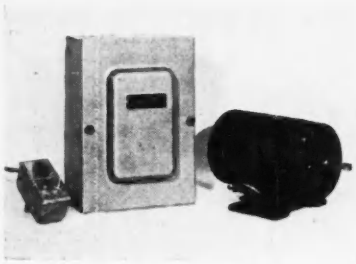
Motor-X Products Co, Cincinnati 8, Ohio

Concrete Cutter

DynArc is said to cut or melt stone, concrete and refractory materials. Using a high temperature electric arc to accomplish the job, the equipment required consists of a coated two-conductor electrode, a special electrode holder, and a dc welding machine that has a capacity of 400 amp or greater.

The arc is formed between the electrode's two conductors, which are connected to the two welder terminals. A flame length of 5 to 8 in. at a temperature, up to 8,000F, depending on the welding-machine ampere setting, is said to result.

Eutectic Welding Alloys Corp, Flushing, N. Y.



Speed Controller

For series or universal motors, the electronic Servospeed systems provide smooth stepless speed control and employs a composite torque-speed feedback signal. A speed range of as much as 100 to 1 is achieved with motors having a base speed of 5,000 rpm or higher, it is claimed. They are available for 1/100 to 1/10-hp motors that operate on 115 v, 50 or 60 cps.

Servospeed Division, Electro-Devices, Inc, Paterson, N. J.

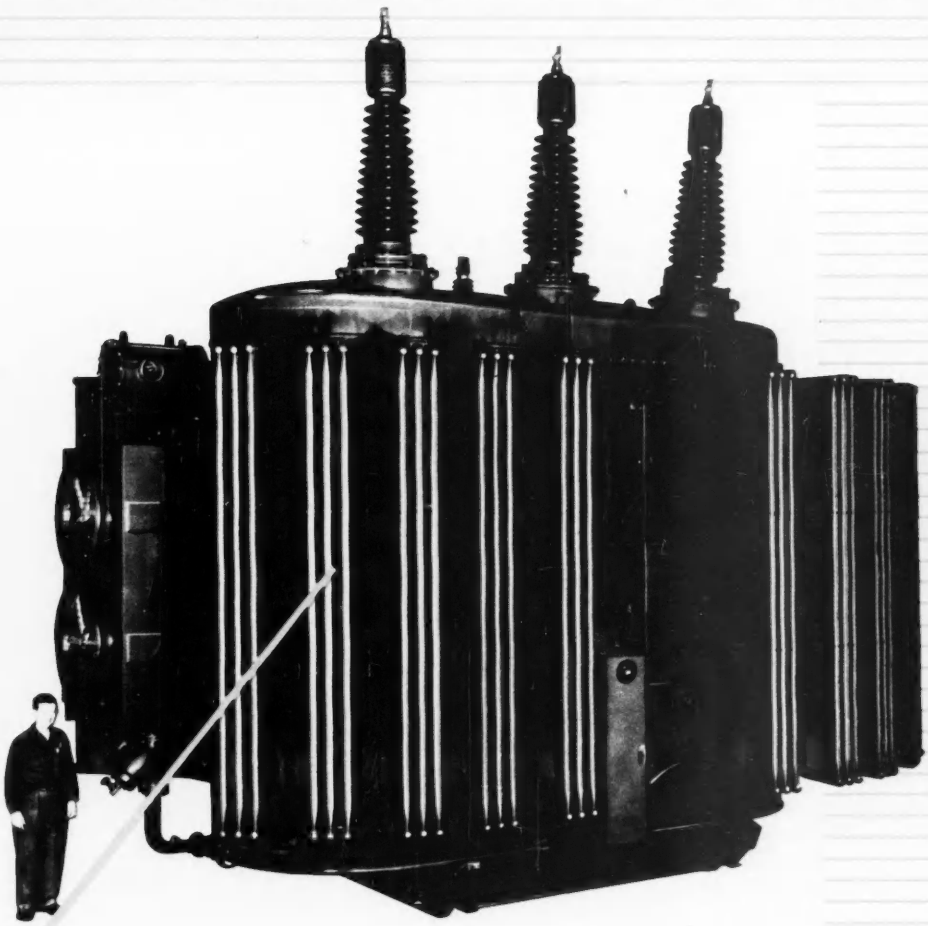
MORE NEW PRODUCTS
about which you should know

Holub Industries, Inc, Sycamore, Ill., announces a **screw-on connector** consisting of a Bakelite shell and cone-shaped metal spring insert, for joining No. 16 and 18 wires . . . Slater Electric & Manufacturing Co, Inc, Woodside, N. Y., has a 15-amp, 125-v, **grounded duplex receptacle** designed to accommodate both 3-wire tangential bladed caps and convention 2-wire parallel bladed caps.

Reliance Electric & Engineering Co, Cleveland 10, Ohio, announces an all-electric **adjustable-speed drive** rated from ¾ to 3 hp . . . Shallcross Manufacturing Co, Collingdale, Pa., has two single-deck single-pole **rotary switches** designed for switching of experimental apparatus or heavy duty test equipment.

Paint Corp of America, Cleveland, Ohio, announces the addition of three colors to the PCA **anti-rust paint line.** . . . All-State Welding Alloys Co, Inc, White Plains, N. Y., has a high-capillary silver-bearing **stainless-steel solder** that is applicable with a soldering iron or torch at 430 F.

Remington Raid Inc, New York, N. Y., announces a small **reproducing machine** that provides a positive copy from originals up to 14½ in. wide.



58,000 Kva *Three Phase*
Pennsylvania Power Transformer

With its two forced-oil — forced-air heat exchangers in operation, this triple-rated Pennsylvania power transformer is capable of delivering 58,000 Kva. When one heat exchanger is in operation, the rating is lowered to 46,400 Kva. When the transformer operates without heat exchangers, it has a rating of 34,800 Kva. The unit is designed to step down a transmission voltage of 161,000 volts to 13,200 volts.

Pennsylvania Transformer Company

A McGraw Electric Company Division

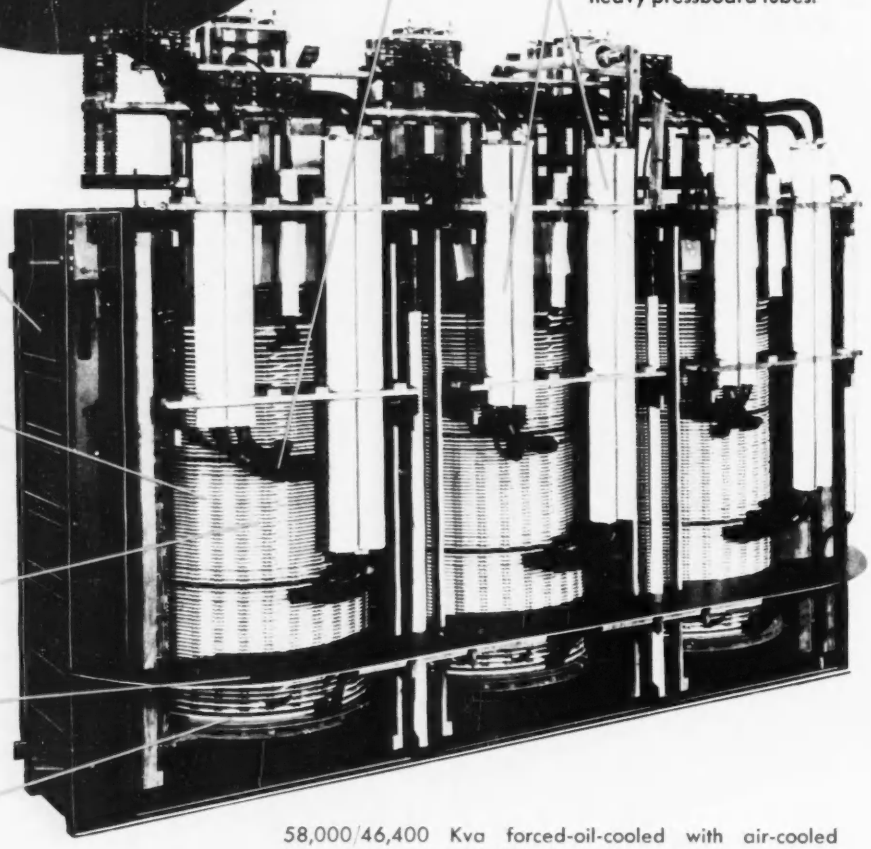
Canonsburg, Pennsylvania • *Greater Pittsburgh District*

SEE NEXT PAGE
FOR INSIDE STORY

Inside a 58,000 Kva *Three Phase* Pennsylvania Power Transformer

Two sets of taps per coil assure excellent electrical and mechanical balance in the windings.

All leads are well supported and insulated in heavy pressboard tubes.



Five-legged core reduces height of transformer.

Coils are precompressed with a force equal to the highest short circuit stress and built into transformer at the compressed dimension. This prevents mechanical distortion of the coils if short circuit stresses occur.

Continuous pancake winding in high voltage coils; helical winding in low voltage coils.

Baffle to direct forced oil throughout the coils for more effcient cooling.

Extra heavy insulation at line ends of coil graded down to 46 Kv on neutral ends.

58,000/46,400 Kva forced-oil-cooled with air-cooled heat exchangers. 34,800 Kva self-cooled. Three phase, 60 cycles, 55°C. Temperature rise. High voltage: 161,000 volts Y. Low voltage: 13,200 volts Delta.

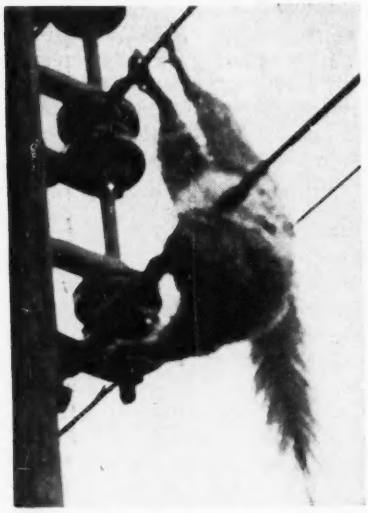
For exterior view of this transformer, see other side.

Pennsylvania Transformer Company

A McGraw Electric Company Division

Canonsburg, Pennsylvania • *Greater Pittsburgh District*

LETTERS TO THE EDITOR



He Won't Do It Again

To the Editor:

I have enclosed a picture that I thought you might be interested in receiving. This squirrel was killed when he got across our 220-v secondary distribution system. There was no interruption of service, and the squirrel was removed from the line only after we had received a report from our field inspectors.

Charles J. Hosking
Asst to the Supt of Dist
Bridgeport Division
United Illuminating Co
Bridgeport, Conn.

Heating by Wind Power

To the Editor:

I propose a new approach to the problem of utilizing power from the winds. It is by generating heat directly from the wind-driven propeller shaft through a fluid friction heater. Development work on fluid friction heaters indicates they can be extremely simple and low in cost.

The whole idea is based on the fact that all energy reverts to heat as it is spent. Efficiency is high because all power loss yields heat. Power loss is the desired function of the heating unit. Only losses that do not contribute to useful heat are in the transmission of the power from the propeller to the fluid heater. Assuming transmission losses can be kept low, the overall efficiency of the plant can be very high.

Since fluid is the sole means for absorbing the power, mechanical parts are kept at a minimum. Power from a wind propeller changes to the cube of the wind velocity. Thus power increases eight times when wind velocity is doubled. Each hphr of mechanical energy that is absorbed by the fluid friction heater will give up 2545 Btu of heat.

Fluid friction units can be made to absorb a wide range of power, therefore a much wider than usual range of wind velocities can be used. I believe wind plants of this type can be designed to operate without speed governors up to one hundred mph or more.

The main reasons for designing a plant to make full use of winds up to 100 mph and over are to keep the plant design as simple as possible and to extract every bit of wind energy that is available. Every gust would thereby be used to its fullest extent.

Application of wind-propelled heating might range from homes to steam stations. Storage of wind power is essential. Water is an excellent low cost medium of storage for heat. In steam station application the heat generated by wind-powered fluid heaters can contribute directly to the heating of feed water thereby reducing fuel consumption.

Wind velocities are highest in the colder months which ties in nicely with heat demand. Altogether the idea of generating heat directly by wind power appears to offer very real possibilities.

John Albers
Secretary
Wincharger Corporation
Sioux City, Iowa

Forecast Reprints

To the Editor:

We at Bendix have reviewed with interest the appliance industry forecasts which appeared in the May 18 issue of Electrical World. We wish to take this opportunity to congratulate you and your staff for the fine job that was done.

We intend to refer to your article many times during the forthcoming months, and it would greatly facilitate the use of the material if we could obtain several additional copies of it. I wonder if perhaps reprints are available which could be forwarded to us? If so, three copies would serve our needs very nicely.

James Ruff
Asst to the Director of Market Research
Bendix Home Appliances
South Bend, Ind.

• Reprints are available.

Others Can Do Likewise

To the Editor:

A belated, but nonetheless sincere, comment regarding the splendid feature story, "Commercial Electric Cooking—A Neglected Load," published in March 23 issue of Electrical World. I would like you to know that it certainly has been helpful to us in our company.

Right now we are mailing another 120 reprints which were supplied us by Hotpoint, together with a letter which points up the importance of this load. The letter and enclosure are being sent to all division vice presidents, district and local managers, and commercial sales personnel over our system.

Luther T. Cale
Manager, Commercial Sales
Alabama Power Co
Birmingham, Ala.

• This excellent promotional effort by Alabama Power Co might well be duplicated by other companies.

We Twisted This One

To the Editor:

I would like to call your attention to a typographical error on page 150 of the June 1 issue of Electrical World.

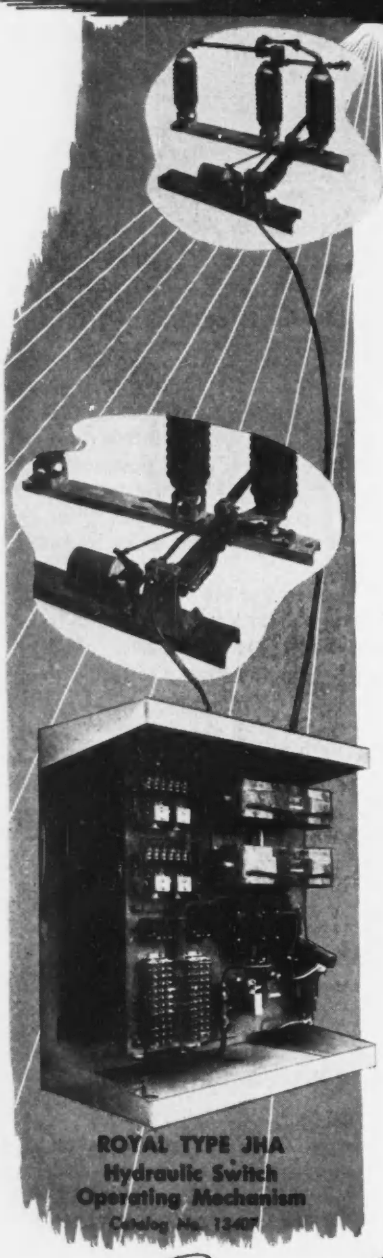
In your article captioned "Harlan Electric Submits Low Bid for Detroit Unit," you quoted the General Electric Co's bid for the turbine-generator unit as being $2,900,500. The correct figure for the General Electric bid should have been $2,009,500.

D. H. Gordon
Large Steam Turbine and Generator Dept
General Electric Co
Schenectady, N. Y.

• Mr. Gordon's figure is right.

Stored ENERGY

NOW APPLIED TO HYDRAULIC SWITCHING



ROYAL TYPE JHA
Hydraulic Switch
Operating Mechanism
Catalog No. 1240T

After two years of research and development ROYAL ELECTRIC MANUFACTURING COMPANY, originator of hydraulic-operated power switching equipment, now supplements its popular hand and motor hydraulic units with the new type JHA mechanism, in which energy is stored for instantaneous switching operations, independent of station power. A hydraulic accumulator, employing an inert gas bladder under pressure, stores the energy indefinitely until needed.

ADVANTAGES

- Multiple operation, without station power.
- High-speed operation. Adjustable time cycle.
- Repeated, remote line sectionalizing or tandem switching operations.
- Control and pump motor circuits independently wired, can be fed from the same or different sources.
- Unit will operate two or more switches, with separate relaying for each.
- Pump automatically maintains accumulator pressure.
- For all control voltages. Adaptable to any group operated switch.

ROYAL hydraulic switch operating mechanisms have been supplied for several years in hand and motor-operated types. They are easy to install, without elaborate layout drawings. No mechanical linkages are required; slave cylinder is connected directly to switch. Connecting tubing is readily formed for attachment to existing or new substation structures, and can be run underground or overhead to a central control point.

● Catalog No. 12 listing ROYAL connectors, switches and substation fittings has just been published. Write for your copy.

Royal

A Part of the Arsenal of AMERICAN POWER PRODUCTION

ROYAL ELECTRIC MANUFACTURING COMPANY
INCORPORATED
1122 EAST 87th STREET Chicago 19, Ill.

Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

Generation Milestone

(*Continued from page* 76)

sign consideration to assure that it will satisfactorily absorb the slugs of water and steam which will be dumped into it by the recirculation valves which are part of the starting-up procedure.

Condenser Will Be 2-Pass Type . . . Because of limited circulating water availability and the desire to utilize existing tunnels, a two-pass condenser will be utilized. Similar precautions must be taken in the selection of tubes and tube sheets as in the case of the feedwater heaters to provide adequate life in the face of the relatively high pH of the steam. As any solids which enter with the feedwater must either pass through the steam generator tubes and turbine and continue to circulate in the cycle or be deposited in these tubes, the turbine, or elsewhere, it is imperative that the cycle be made as hermetically tight as possible. This precaution will be observed throughout the cycle but will be especially stressed in the condenser where the biggest possible source of contamination exists. Every possible means will be utilized in order to make the condenser completely tight.

Problems Anticipated . . . Every effort will be made to anticipate a number of operating problems during the initial stages of operation of this unit. Water conditioning and the control of solids in the steam generator, turbine, and other parts of the cycles are problems which will have to be carefully watched and which probably will lead to new concepts in the treatment of feedwater.

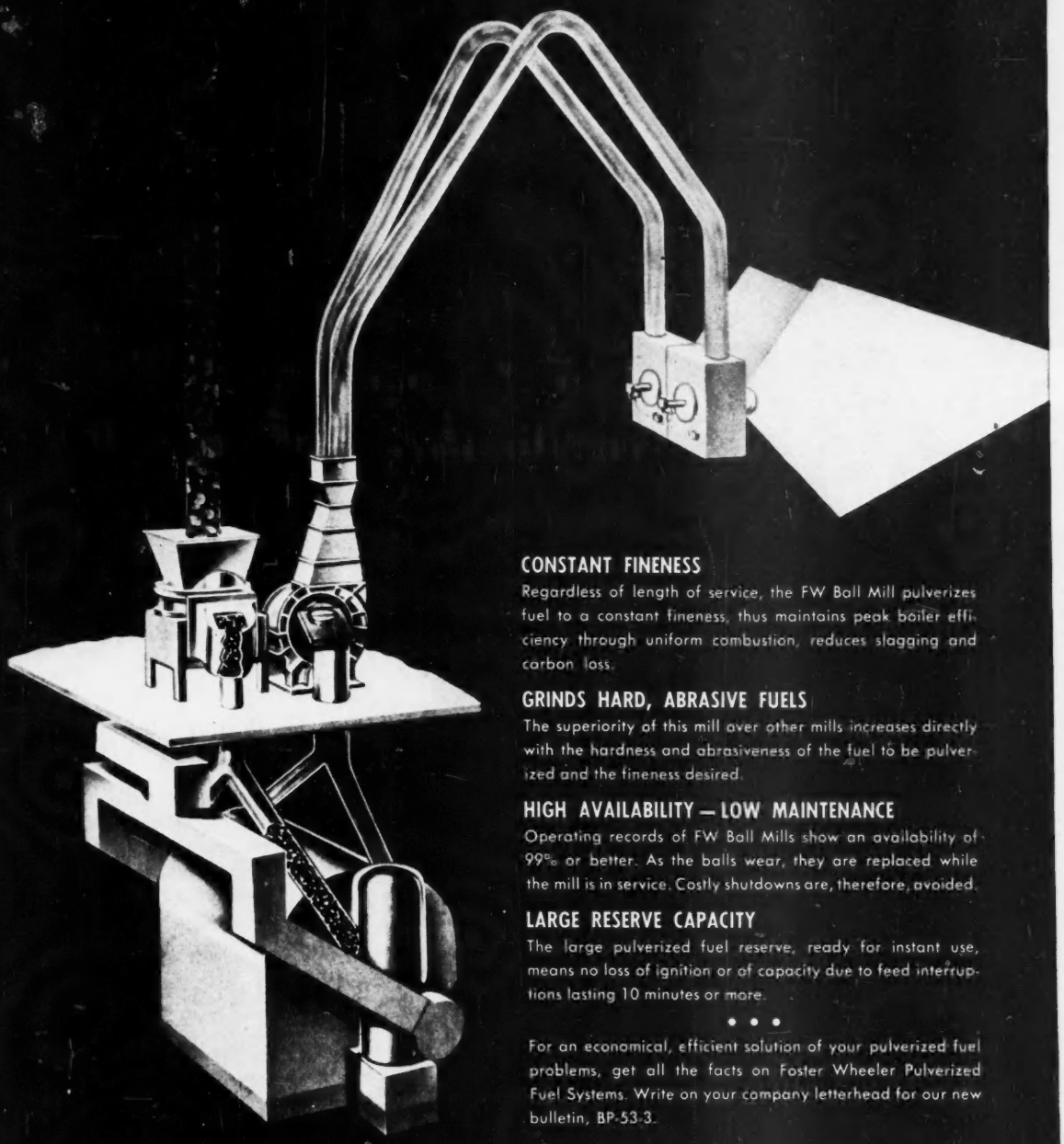
Control of flow, especially in valves subjected to the tremendous pressure drops contemplated, is a problem which will require not only the best thinking during design stages but may require some design changes after initial operation.

Control of the cleanliness of the heat absorbing surfaces and of the steam and reheat temperatures will require careful attention and planning. This problem is being tackled experimentally.

Starting and shutdown procedures will have to be carefully worked out during the first stages of operation

(*Continued on page* 140)

Only FW PULVERIZED FUEL SYSTEMS
bring you all 4 important advantages



CONSTANT FINENESS
Regardless of length of service, the FW Ball Mill pulverizes fuel to a constant fineness, thus maintains peak boiler efficiency through uniform combustion, reduces slagging and carbon loss.

GRINDS HARD, ABRASIVE FUELS
The superiority of this mill over other mills increases directly with the hardness and abrasiveness of the fuel to be pulverized and the fineness desired.

HIGH AVAILABILITY — LOW MAINTENANCE
Operating records of FW Ball Mills show an availability of 99% or better. As the balls wear, they are replaced while the mill is in service. Costly shutdowns are, therefore, avoided.

LARGE RESERVE CAPACITY
The large pulverized fuel reserve, ready for instant use, means no loss of ignition or of capacity due to feed interruptions lasting 10 minutes or more.

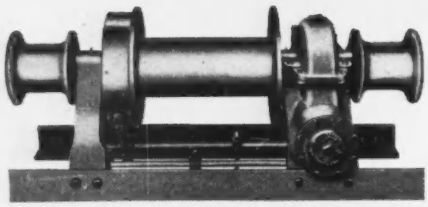
• • •

For an economical, efficient solution of your pulverized fuel problems, get all the facts on Foster Wheeler Pulverized Fuel Systems. Write on your company letterhead for our new bulletin, BP-53-3.

FOSTER WHEELER CORPORATION • 165 Broadway, New York, N. Y.

FOSTER WHEELER

TULSA* WINCHES



The Model 23 Tulsa Winch is installed on the truck below. There are 27 other models in capacities from 6,500 to 80,000 lbs. for all makes and models of trucks and crawler tractors.

FOR HAULING...

Loading and unloading 3-ton cable reels is a simple task for this California trucking contractor. Working for a West Coast public utility, the driver easily, quickly and safely handles these reels of expensive copper cable. His Model 23 Tulsa Winch does the entire job.

Tulsa* Winch
TULSA, OKLAHOMA
DIVISION OF VICKERS Inc.

*Reg. U. S. Pat. Off.

to protect all component equipment and yet to obtain the high degree of flexibility which is inherent in this Universal Pressure type steam generator.

Behavior of the various alloy steels at these high temperatures and pressures will have to be carefully observed as no operating experience is available at these conditions.

These are some, but by no means all, of the many problems which will have to be faced to a lesser or greater degree. It is expected, however, these will be satisfactorily solved during the design and construction or during the initial operating period of this machine.

Throughout all of the design work ahead sight will not be lost of the two primary aims of this entire project of both developing new techniques and design arrangements that will yield immediate improvements, as well as pointing the way toward the design of units which will provide even more economical techniques of electrical energy generation. This project is significant, therefore, not only for the many new major steps being taken, but also because of steps ahead—the prospects for further improvements in the economics of steam electric power generation that loom on the horizon and that are ahead.

Dairyland Co-op Gets $3 Million REA Loan

Rural Electrification Administration has approved an additional $3.3-million loan to Dairyland Power Cooperative of Lacrosse, Wis.,—largest single loan approved since Republican Administrator Ancher Nelson took over.

The funds to be made available are to be used together with previously approved loans for construction of 186 miles of transmission line and related substations. The lines will include 75 miles of 138-kv capacity to be operated initially at 69 kv; 56.5 miles of 69 kv, and 54.5 miles of 34.5 kv.

Dairyland Power is a federation composed of 25 distribution co-ops in Wisconsin, Illinois, Iowa, and Minnesota. Previous to the recent loan, Dairyland Power had obtained federal loans totalling approximately $47.7 million.

Dispatcher takes data received on Speedomax Load Recorders, left, and uses it to control system generation with console, extreme right.

25 years of systematic development...

reflected in industry-wide adoption of L&N Load-Frequency Control

Interconnected operation of power systems has resulted in improved reliability, economical interchange of power, and greater operating flexibility. These advantages, which are so important in planning for future load growth, are possible because of two basic techniques which have evolved from years of operating experience:

1. the load dispatcher for each system is given immediate and complete information concerning load and generation conditions in that system.

2. each system absorbs as much of its own customer load changes as possible.

Leeds & Northrup system control achieves these two operating techniques because L&N progress has been "in phase" with changing utility operating requirements during the past 25 years. Speedomax Telemeters bring an almost instantaneous appraisal of system load facts to the load dispatcher's attention; L&N Load-Frequency Control automatically regulates the system's generating plants to maintain desired schedules of net power flow into or out of the system.

And L&N equipment is backed by field engineers who have extensive experience in power plant applications. Whether yours is a small utility, or a large one—interconnected or isolated—L&N equipment and engineering are ready to help you prepare for future load growth.

For details, write to 4938 Stenton Avenue, Philadelphia 44, Pa.

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Honeywell service men are schooled not only in the theory of measurement and control, but also in the practical art of keeping good instruments in the best condition. Hand picked men begin this instrument education in an intensive training program in Honeywell factories. After graduation, they serve an apprenticeship in the field offices . . . while they learn still more about instrument maintenance from first-hand contact with plant problems. By the time a Honeywell man arrives at your plant on a call, he's a finished product worthy of the responsibility he bears, and capable of doing the kind of service job that you need . . . and that your Honeywell instruments deserve.

When trouble strikes, a wire or telephone call will bring a service man to your plant . . . often within a few hours. This assurance of prompt action means a lot to your production schedules. You'll never be left out on a limb because of delays in instrument maintenance.

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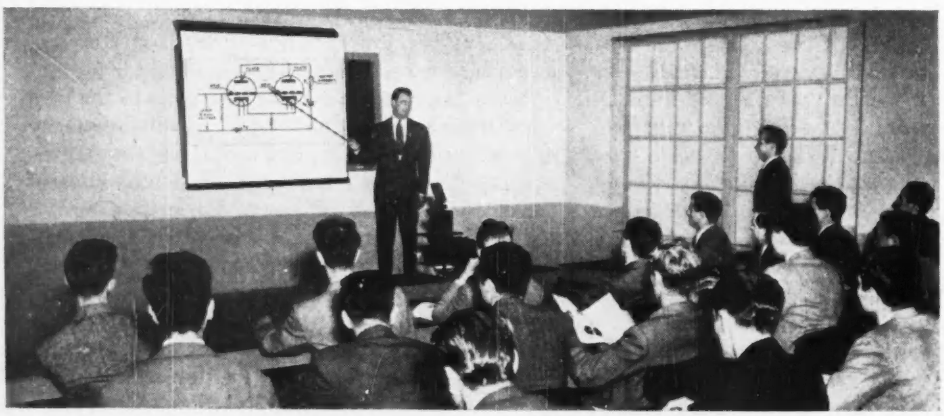
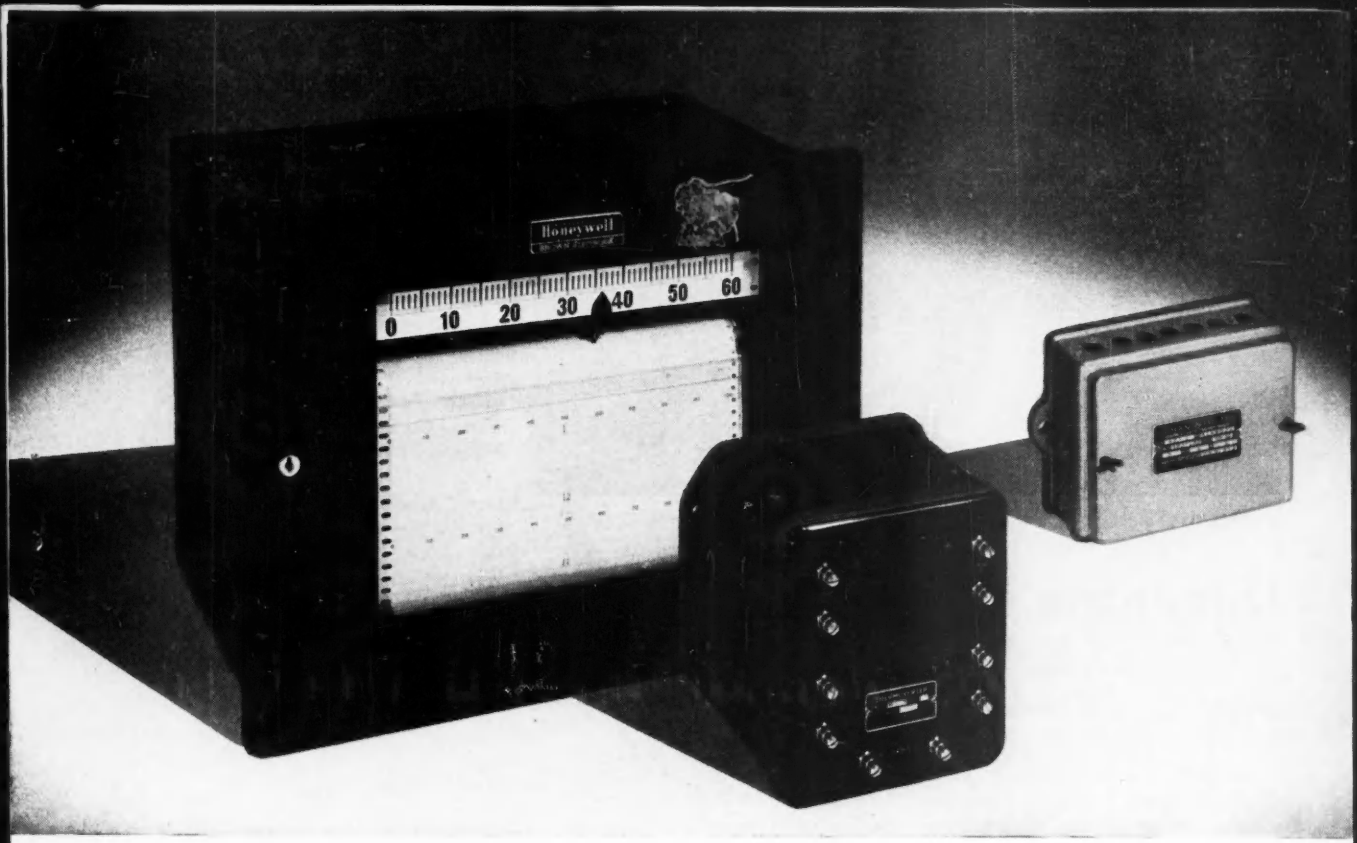
But why wait for emergencies? Preventive medicine works on instruments, too. And the prescription is simple . . . a Periodic Service Contract, which brings a Honeywell service man to your plant at regular intervals to inspect, clean and adjust any Honeywell instruments you have. The plan is economical . . . can save you many hours of lost production time. Your nearest Honeywell office will be glad to give you full details.

For accurate *depend on*



TRAINED TO SERVE: *In Honeywell's service school, students get a thorough grounding in instrument theory and practice. After graduation, they become part of the most extensive organization of its kind in the world . . . ready to serve you competently and promptly, whenever and wherever you need them.*



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ElectroniK recorders

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They're extra-readable: 11-inch wide chart and scale spread load data out in full, legible detail.

They're versatile: supplied in any desired kilowatt or megawatt range; operate with a thermal converter connected to standard instrument transformers. Adding a phasing transformer adapts them to measurement of reactive power.

They're dependable: like the thousands of *ElectroniK* instruments used throughout industry for temperature, pH, flow, and scores of other measurements, *ElectroniK* power recorders have exceptionally few moving parts . . . no delicate mechanical linkages . . . utilize rugged, life-tested components.

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● **REFERENCE DATA: Write for Data Sheet No. 9.1-3 . . . and for Catalog 90-2, "Supervisory Instruments for Power Generation."**

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RALPH R. PARKMAN

CARROLL T. SINCLAIR

Duquesne Light Elects 3 VPs

Walter Lyman, Ralph Parkman, and Carroll Sinclair are advanced to executive posts. Hegmann becomes comptroller

Walter J. Lyman, Ralph R. Parkman and Carroll T. Sinclair have been elected vice presidents of Duquesne Light Co. In another appointment, Edward H. Hegmann was made comptroller.

Lyman, formerly manager of the planning and development department, will be in direct charge of and responsible for all activities of the Operating Division. Parkman, who has been assistant to the chairman of the board, now will be directly responsible for all activities of the Fiscal Division, which will be comprised of the accounting, treasury, and the secretary's departments. Sinclair, who has been chief engineer in charge of engineering and construction, will be in direct charge of and responsible for the Engineering and Construction Division's activities. Hegmann will be in direct charge and responsible for all activities of the accounting department.

Began As Apprentice Engineer . . . After graduating from Carnegie Institute of Technology in 1924 with a BS degree in electrical engineering, Lyman entered the employ of Duquesne Light as an apprentice engineer. Since then he has served as a junior engineer and assistant field engineer in the engineering department, and as section engineer and manager in the planning and development department, a post he held until the present appointment.

Parkman, who graduated from the University of Maine with a BS degree in electrical engineering in 1926, started that same year with Duquesne Light as an apprentice engineer. After serving with Pittsburgh Railways Co, he joined the Philadelphia Co in 1944 as technical assistant to the senior vice president, becoming assistant to the executive vice president two years later. He was made assistant to the board chairman of Duquesne Light in 1950. Duquesne Light and Pittsburgh Railways are subsidiaries of Philadelphia Co, which is controlled by Standard Gas & Electric Co.

Sinclair, who graduated from Lehigh University in 1917 with an EE degree in engineering, began with Duquesne Light in 1925 as supervisor of transmission and distribution engineering. He was named to the chief engineer's post in 1947.

Associated with Philadelphia Co since 1937, Hegmann served as an accountant, assistant to the general auditor, and auditor of receipts before becoming general auditor in 1946, a position he held until now.

•

Clyde Bohl, superintendent of the Northern Production and Transmission Division of Consumers Power Co, has been appointed superintendent of the utility's Western Production and Transmission Division to succeed the late Hubert G. Holmes. Bohl's former post will be assumed by **Leon M. Day,** assistant division superintendent of Western P&T.

Frank R. Joslin, assistant construction manager of New England Power Service Co, Boston, since 1947, has been promoted to construction manager to succeed **Lester Gurney,** who has retired. Gurney began with the New England Power system in 1918.

David MacGregor, chief engineer of Edward Valves, Inc, has been assigned the additional duties of works manager and **Carl L. Erwin** has been promoted to assistant works manager. MacGregor, who will continue as chief engineer, will supervise all manufacturing operations and industrial relations. In his new assignment Erwin, formerly personnel manager, will continue to participate in employment affairs and industrial relations.

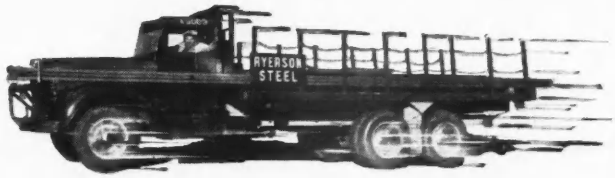
CHARLES A. WICK

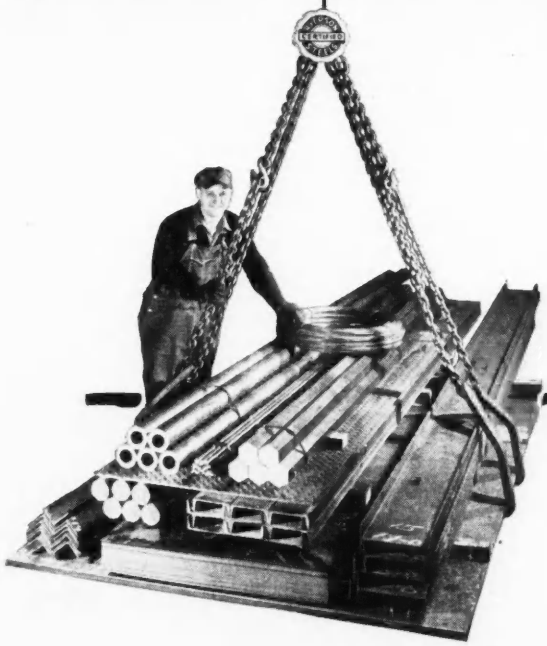
Elected a Vice President

Niagara Mohawk Power Corp has elected Charles A. Wick to the post of vice president. On Sept. 1 Wick will sever his connection as a partner in the Buffalo law firm of Garono, Jaeckle, Kelly & Wick and will become identified with Niagara Mohawk activities in western New York. Wick is a graduate of Canisius College and the University of Buffalo Law School. He has also been a lecturer on law at both these educational institutions.

(*Continued on page* 147)

For quick delivery





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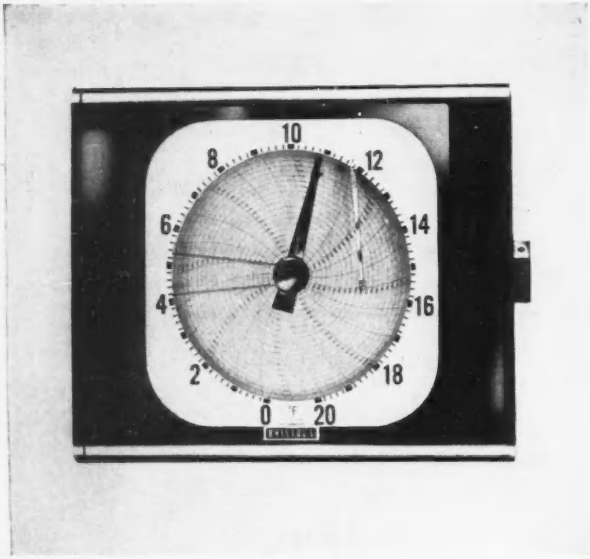
feature Continuous Standardization!



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No dry cells to fuss with . . .

thanks to Bristol's constant voltage source, which is continuously compared with the voltage of a standard cell.

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No wonder the Dynamaster is the finest-performing potentiometer on the market!

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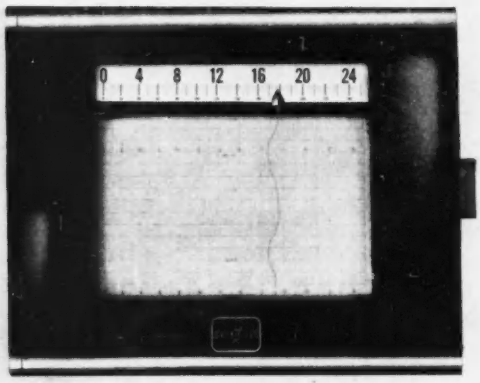

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AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

A. W. TRIMBLE

Nelpa Elects Trimble as Its New President

Northwest Electric Light & Power Association has elected A. W. Trimble, president of Mountain States Power Co, president for the new year to succeed John Dierdorff, vice president of Pacific Power & Light Co.

Other new officers are: First vice president, R. C. Stetterstrom, Montana Power Co; and second vice president, E. M. Naughton, Utah Power Co. J. R. Cawlfield, Mountain States Power, was appointed treasurer and Berkeley Snow was reappointed executive secretary for the 22nd year.

Trimble became associated with Mountain States Power in 1930 when he joined its accounting staff. He was appointed assistant treasurer in 1940 and two years later was named vice president and treasurer. He was elected executive vice president in 1949 and president in 1950. He has been a director of the utility since 1942.

Plier Named President

A. W. Plier has been named president and general manager of D. J. Murray Manufacturing Co, Wausau, Wis., to succeed F. C. Boyce, newly appointed chairman of the board. Plier, who started with the company in 1930, was made secretary in 1944, a director in 1948, and executive vice president and general manager two years later. Boyce has served as president since 1933.

•

Richard L. Boke, director of the Bureau of Reclamation's Sacramento,

NEW one-piece non-shatterable globe

Bullets, stones, rough handling won't shatter the only one-piece plastic street light globe

Breakage problems and high maintenance costs are practically eliminated now that you can install the new Colt one-piece non-shatterable street light globe. And you lose nothing in efficiency, because this modified acrylic resin globe has light diffusion and transmission properties equal to those of any glass globe.

Detroit Edison, Public Service of New Jersey, and Potomac Electric Power Company have already tested the Colt globe, found it ideal for installations with a light output up to 6,000 lumens. Because it weighs only 2 lb. 3 oz., they found it exceptionally easy to clean with regular detergents. Colt globes showed no tendency to discolor or darken after the two-year test.

Maintenance crews like the Colt globe. It's easy to install, rarely needs replacing.

Find out for yourself how you can save money on street light globes. Send the coupon today for full information about Colt's non-shatterable globe.

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Colt's Manufacturing Co., Plastics Division, Hartford 15, Conn.

Please send me more detailed information on the new Colt Globe.

Name ..... Title .....

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Clean! when properly treated...

and so are pressure-creosoted poles!

● It is no problem to get dry, complaint-free pressure-creosoted wood poles. It takes creosote of proper specification for residue and proper pressure treatment. Your treater knows. He can treat wood with creosote so that it stays dry; and he is doing it every day. This is part of his constant effort to turn out an increasingly better and better product.

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Specify pressure-treatment with creosote for all *your* poles. They are dry, clean, and they last and last.

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Calif., Region 2, has resigned effective July 1. He served for nearly eight years as director of that region.

Frank Banks, retired Bureau of Reclamation engineer, has been elected new president of the newly reorganized Columbia Interstate Compact Commission, which will be located in Spokane, Wash. Other officers appointed were **Les Colby,** Missoula, Mont., vice president; and **Mark Kulp,** Idaho reclamation engineer, secretary-treasurer.

OBITUARY

Fremont L. Lovett

Fremont L. Lovett, 64, president of Rockland Light & Power Co, Nyack, N. Y., was killed June 13 when the plane he was piloting crashed near Warren, Vt.

Lovett, a native of Warren, Vt., was graduated from Norwich University in 1913 with BS and electrical engineering degrees. He started his utility career in 1914 as an engineer for the former Worcester Electric Light Co. In 1921 he became manager of the Montpelier & Barre Light & Power Co, Montpelier, Vt. He also served concurrently as secretary and manager of Green Mountain Power Co, Montpelier.

In 1927 Lovett was appointed general manager of Rockland L&P, Rockland Electric Co, Closter, N. J., and Pike County Light & Power Co, Milford, Pa. He was vice president, general manager, and a director of these utilities from 1936 until 1951 when he was elected president of all three com-

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Conventional 7-conductor #9 AWG in 1¼" conduit

PNR 12-conductor #9 AWG 1¼" conduit

- **YOU USE THE SAME SIZE CONDUIT**
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Because Rockbestos PNR Control Cable is 46%* smaller in area than competitive control cables, it enables you to put 12-conductor PNR where you would use 7-conductor cable. This means you save critical steel conduit and fittings, because you put more conductors in a given conduit. Write for the PNR story.

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panies. He was made a director of Brockton (Mass.) Gas Light Co in 1940.

Walter S. Finlay, Jr

Walter S. Finlay, Jr, 70, executive vice president and a director of J. G. White Engineering Corp, New York, died at New Rochelle, N. Y., June 17.

Finlay was named vice president of the company in 1939, becoming executive vice president in 1940. Prior to this he served for 12 years as president of West Penn Electric Co. From 1920 to 1927 he was vice president of American Water Works & Electric Co. In the early part of the century, he was associated with the White company for about six months as a construction engineer in New England.

He was a member of the American Institute of Electrical Engineers and American Society of Mechanical Engineers.

Melvin C. Wilt, 52, president of Curtis Lighting, Inc, died June 11. With Curtis Lighting since 1928, he organized the firm's Canadian subsidiary in 1931, remaining in Toronto for ten years. He was made executive vice president and general manager of the American firm in 1940 and president in 1945. He was appointed president of Curtis Lighting of Canada, Ltd, in 1942. Before joining Curtis Lighting, he was assistant commercial manager for Appalachian Electric Power Co. Wilt was a former president of the Chicago Lighting Institute.

R. Leslie Beattie, 62, vice president and general manager of Canadian operations of International Nickel Co of Canada, Ltd, died June 10 at Toronto, Ont. He assumed the executive posts in 1942.

George L. Diggles, 65, a director of Electrical Testing Laboratories, Inc, New York, died June 17 at Greenport, L. I., N. Y. After more than 44 years' service, he retired as superintendent of the firm's lamp inspection division about a year ago. Prominent in the field of lamp inspection techniques, he had written papers on quality control.

Charles T. Mossman, 83, formerly electrical engineer for General Electric Co in the Boston district, died June 13 at Boston, Mass.

NEW TIME RECORDER OF PM-13 NEEDS ONLY PERIODIC ADJUSTMENT (SHOWN ABOVE)

GENERAL ELECTRIC ANNOUNCES . . .

New Automatic Oscillograph

General Electric's new PM-13 oscillograph is designed to automatically record power-system transient disturbances. Equipped with seven fluid-damped galvanometers, the instrument simultaneously records seven electrical wave forms that have been pre-selected by the system engineer.

In power-company generating and switching stations, the new PM-13 may be used to measure and record such quantities as residual current, phase current, phase/ground potentials, phase/phase potentials, and Kw or Kva. Information provided by the oscillograph enables the system engineer to analyze the performance of circuit breakers, relays, or systems; and to locate system faults.

NEW LIGHT SOURCE

A flooding-type light source illuminates all seven of the new instrument's galvanometers. Because no lenses, prisms, or aperatures are used, no time-consuming optical adjustments are necessary when replacing lamps.

IMPROVED TIME RECORDER

The new PM-13 oscillograph is equipped with an automatic time recorder which photographically records the time and date of operation on the face of the oscillogram. For station or company identification, a plate may be added to the time mechanism.

UNIT CONSTRUCTION

Constructed of simplified unit subassemblies, the front relay panel of the new G-E oscillograph is easier to inspect and maintain.

SIMPLIFIED PAPER HOLDERS

New, light-tight record paper holders mount easily on the top of the oscillograph. Holding up to 200 feet of record paper, the new holders make it possible to obtain as many as 100 oscillograms without adding paper.

FURTHER INFORMATION

For further information, contact your local G-E Apparatus representative, or write for Bulletin GEC-396 to: Section 605-41, General Electric, Schenectady 5, N. Y.

You can put your confidence in—

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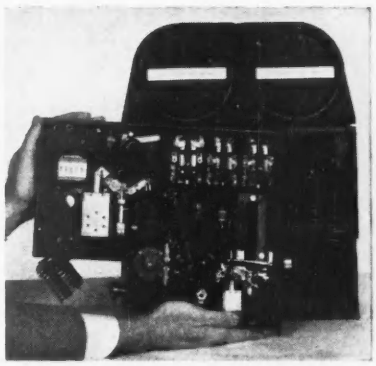
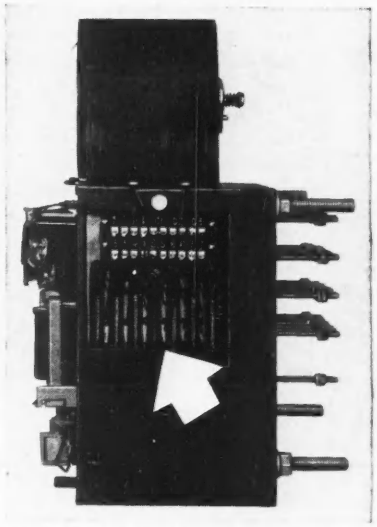
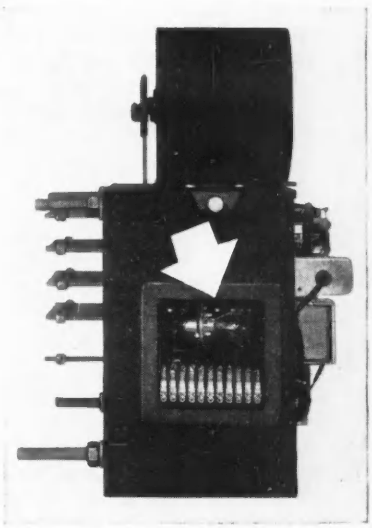


UNIT SUB-ASSEMBLY CONSTRUCTION permits easy removal of the front panel for adjustment and repair.



SEVEN GALVANOMETERS (arrow) are easily accessible on right side of unit; provide for seven simultaneous records.



LIGHT SOURCE (arrow), left side of unit, is easy to replace; no time-consuming optical adjustments are required.

Class H Insulation Usage . . .

. . . in power plants is analyzed at Electrical Apparatus Conference sponsored by Owens-Corning Fiberglas Corp

Talks on glass insulation highlighted the Electrical Apparatus Conference held recently at Bedford, Pa., under the sponsorship of Owens-Corning Fiberglass Corp, New York. More than 125 officials of utilities, electrical apparatus manufacturers, and railroads attended the meeting.

Speaking on electrical insulation problems in utility power plants, John G. Noest, assistant inside plant engineer, Consolidated Edison Co of New York, Inc, related that experience justifies the small increased cost of rewinding station auxiliary motors (200-2,500 hp) with silicone-glass insulation.

Noest said that for power plant use, a major trend towards Class H insulation, using fiber glass and silicones, should develop as users recognize the advantages of this type of insulation.

Cable Connections . . . With the use of Class H insulated motors, transformers, and enclosed switchgear, Noest pointed out that the major insulation problem of cable connections to this equipment still remains.

"Use of High-Temperature Insulations in Dry-Type Transformers" was the topic discussed by W. W. Satterlee, manager of network and power transformer engineering, Westinghouse Electric Corp. He said many forms of fiber glass contribute to heat and moisture resistance, and improved design and operating life of dry-type transformers.

Looking to the future, Satterlee said industry should be thinking about the following:

1. Can we expect a glass paper of suitable strength and density and at a cost comparable or less than that of kraft paper?

2. Can we imagine glass string the equal of linen thread?

3. Is it possible that significant advances will develop in sizings, binders, coatings, and impregnants for glass and other inorganic materials rather than from developments in the materials themselves?

Products Exhibited . . . Some recently developed fiber-glass products exhibited were: (1) Glass tape (0.004 in.) for Class A insulation, by Hess Goldsmith Co, Hope Webbing Co, and Russell Manufacturing Co; (2) glass mat-base laminates, Formica Corp; (3) varnished glass cloth for Class A applications, Electro-Technical Products Co; (4) sleeving and tubing of fiber-glass base for Class A insulation, Atkins & Pearce Co, Briscoe Manufacturing Co, Suflex Corp, and Varflex Corp; and (5) high-impact phenolic molding compound reinforced with Fiberglas, Durez Plastics & Chemicals, Inc.

Refined Copper Stocks Increase During May

Stocks of refined copper held in the United States by members of the Copper Institute, Inc, at the end of May amounted to 52,762 tons, an increase

Breaks Ground for Research Center

Westinghouse Electric Corp recently broke ground for "the most modern Research Center in the electrical industry." Dr John A. Hutcheson, vice president director of research, is shown turning the first shovelful of earth at the ceremony held on a 70-acre plot about 10 miles east of downtown Pittsburgh's Golden Triangle. A. C. Monteith (center), vice president in charge of engineering, and Dr C. R. Hanna (left), associate director, watch Dr Hutcheson wield a new titanium spade, reported to be the only one of its kind in the world.

Scheduled for completion in 1955, the "L"-shaped, three-story building will be one-third larger than the present laboratories, located only a few miles from the new site.

2, 4, 5-T
FORMULATIONS

better than a hundred hands!

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of 4,380 tons above the 48,382 tons held on April 30.

During May deliveries to domestic fabricators increased to 146,815 tons compared with deliveries of 142,282 in April. Refined production also increased to 117,929 tons from 112,660.

Outside the United States refined stocks totaled 147,234 tons on May 31, an increase of 260 tons above the 146,974 tons on April 30. May deliveries dropped to 61,082 tons from 63,215 tons in April and refined production was 97,235 tons compared with 102,903.

MANUFACTURING BRIEFS

General Services Administration has announced that independent aluminum fabricators will get more than 90 million lb of aluminum during the third quarter.

General Electric Co's welding department, located at Fitchburg, Mass., since 1946, will be transferred to York, Pa., by the end of March, 1954. The department is scheduled to move into a newly vacated company plant at York, which will allow room for manufacturing expansion. The plant formerly housed GE's Wire and Cable Division, which is being moved to Bridgeport, Conn., and Lowell, Mass.

Opening of a new warehouse and sales center in Wichita, Kan., for steel products, chemicals, and fuel has been announced by Colorado Fuel & Iron Corp, New York. The new center, which will occupy 30,000 sq ft of floor space, will serve Oklahoma, Nebraska, Missouri, and Kansas.

G&W Forethought, a new house publication issued by G&W Electric Specialty Co, Chicago, made its initial appearance recently when the first issue was mailed to key personnel of electric utilities companies and industrial concerns. The eight-page publication will feature articles describing typical installations of G&W equipment throughout the country. Plans call for six issues per year.

Sylvania Electric Products, Inc, plans to build two plants. A 416,000-sq ft television set manufacturing plant will be built in Batavia, N. Y., in anticipation of greatly increased production and sales of the firm's TV sets. Sylvania is purchasing a 20-acre site in Fullerton, Calif., to erect a new TV picture tube plant to handle requirements of the West Coast market . . . **Industrial Tape Corp,** New Brunswick, N. J., manufacturers of Permacel and Texcel pressure sensitive tapes, has changed its name to Permacel Tape Corp.

SALES ASSIGNMENTS

COMPANY STAFFS

Electric Controller & Manufacturing Co, Cleveland, has named A. M. McIntyre manager of its newly opened district office at 1133 S. Brentwood Blvd., St. Louis. Joseph M. Hyland was assigned to the New York sales office and C. B. Chapman, Jr, was transferred to the Detroit office.

Graybar Electric Co. Inc, New York, has announced the following appointments: E. A. Bartlett was appointed manager and F. N. Chance operating manager of the newly established branch at 510 Pearl St., Sioux City, Iowa. Ralph H. Smith is the new manager of the Flint (Mich.) Branch. John Reine was made district manager at Cincinnati and his successor as district manager at Minneapolis is N. W. Zilch. G. L. Call succeeds Zilch as manager at Akron. E. W. Windahl was named manager at Duluth. D. E. Clisbee was appointed manager of the Hammond (Ind.) Branch to succeed J. J. Lieske, Jr, who has been transferred to Washington, D. C., as manager. Lieske replaces F. F. Jaspersen, who has become district sales manager at Philadelphia. Jaspersen succeeds H. N. Wood, who is retiring after 40 years' service. J. T. Baker assumes the managership at the Youngstown Branch to replace W. C. Robinson, who is retiring after 41 years' service. Hamilton Corey was named district sales manager at Atlanta. A. A. Wilson becomes manager at Charlotte to replace Corey. H. S. Corey, Jr, takes over the manager's post at Asheville to succeed Wilson.

Bristol Co, Waterbury, Conn., has appointed Sam E. Gewin district manager of its St. Louis office. Gewin, who joined the company's sales organization in 1937 as sales engineer, has served for the last five years as resident sales engineer in the Buffalo area.

Allis-Chalmers Manufacturing Co's General Machinery Division has designated J. E. Smet manager of the newly established district office at Hartford, Conn. Smet, with Allis-Chalmers since 1946, has served as manager of the New Haven office since 1950. His successor there is F. S. Howard, a sales representative in the New Haven office for the past three years.

REPRESENTATIVES

Marcus Transformer Co, Inc, Hillside, N. J., has appointed Walter Zimmerman as manufacturer's representative to handle dry-type transformer sales in Nebraska, Kansas, and western Montana. His headquarters will be located in Wichita, Kan.

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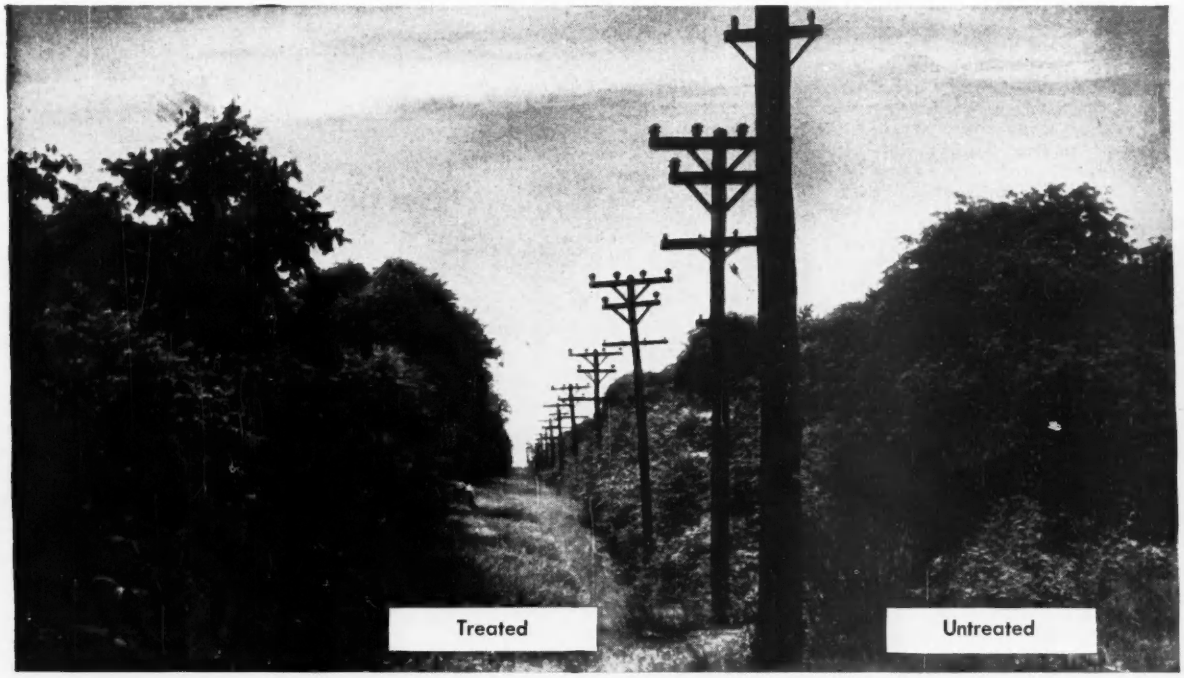

Dow's low-volatility ester brush killers supply the answers to your vegetation control problems on right-of-ways, around substations, pole yards, booster stations, and along fences. Esteron® Brush Killer and Esteron 245 enable your field crews to get their assignments done quickly at savings from 25% to as high as 50% over handcutting methods.

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MEETINGS CALENDAR

American Society of Mechanical Engineers
Semi-Annual Meeting, Statler Hotel, Los Angeles, June 28-July 2; Fall Meeting, Sheraton Hotel, Rochester, N. Y., Oct. 5-7; Annual Meeting, Statler Hotel, New York, Nov. 29-Dec. 4.

American Society for Testing Materials
Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 29-July 3.

Electrical Equipment Representatives Association
Summer Meeting, Hotel Colorado, Glenwood Springs, Colo., July 15-17.

International Association of Electrical Leagues
18th Annual Meeting, Fairmount Hotel, San Francisco, Aug. 5-8.

American Institute of Electrical Engineers
Pacific General Meeting, Hotel Vancouver, Vancouver, B. C., Sept. 1-4; Middle-Eastern District Meeting, Daniel Boone Hotel, Charleston, W. Va., Sept. 29-Oct. 1; Fall General Meeting, Muehlebach Hotel, Kansas City, Mo., Nov. 2-6.

Illuminating Engineering Society
National Technical Conference, Hotel Commodore, New York, Sept. 13-17.

Northwest Public Power Association
Accounting Section, Monticello Hotel, Longview, Wash., Sept. 17-18.

Public Utilities Association of Virginias
Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Sept. 17-20.

Rocky Mountain Electrical League
50th Annual Fall Convention, Broadmoor Hotel, Colorado Springs, Colo., Sept. 20-23.

International Association of Electrical Inspectors
Silver Jubilee Meeting, Edgewater Beach Hotel, Chicago, Sept. 21-26.

Electric League of Western Pennsylvania
4th Industrial Electric Exposition, William Penn Hotel, Pittsburgh, Oct. 6-8.

Indiana Electric Association
Annual Convention, French Lick Springs Hotel, French Lick, Ind., Oct. 7-9.

Edison Electric Institute
Transmission-Distribution Committee, Hotel Nicollet, Minneapolis, Minn., Oct. 8-9; Electrical Equipment Committee, Jung Hotel, New Orleans, La., Nov. 2-3.

Association of Edison Illuminating Companies
Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Oct. 8-10.

National Association of Electrical Distributors
Fall Meeting, Pacific Zone, Hotel del Coronado, Coronado, Calif., Oct. 11-14.

Iowa Utilities Association
Management Conference, Hotel Fort Des Moines, Des Moines, Oct. 12-13.

***Electrical Association of Philadelphia**
Biennial Electrical Progress Show sponsored by Manufacturers' Division, Convention Hall, Philadelphia, Oct. 13-15.

American Standards Association
4th National Standardization Conference and 35th Annual Meeting, Waldorf-Astoria, New York, Oct. 19-21.

Public Information Program
Steering Committee, Edgewater Beach Hotel, Chicago, Oct. 21; Workshop Conference, Edgewater Beach Hotel, Chicago, Oct. 22-23.

Southeastern Electric Exchange
General Sales Conference, Atlanta Biltmore Hotel, Atlanta, Ga., Nov. 4-6.

National Electrical Manufacturers Association
Annual Meeting, Haddon Hall, Atlantic City, N. J., Nov. 9-12.

Wisconsin Utilities Association
Electric-Gas Section Convention, Schroeder Hotel, Milwaukee, Nov. 11-13.

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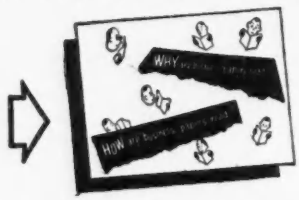

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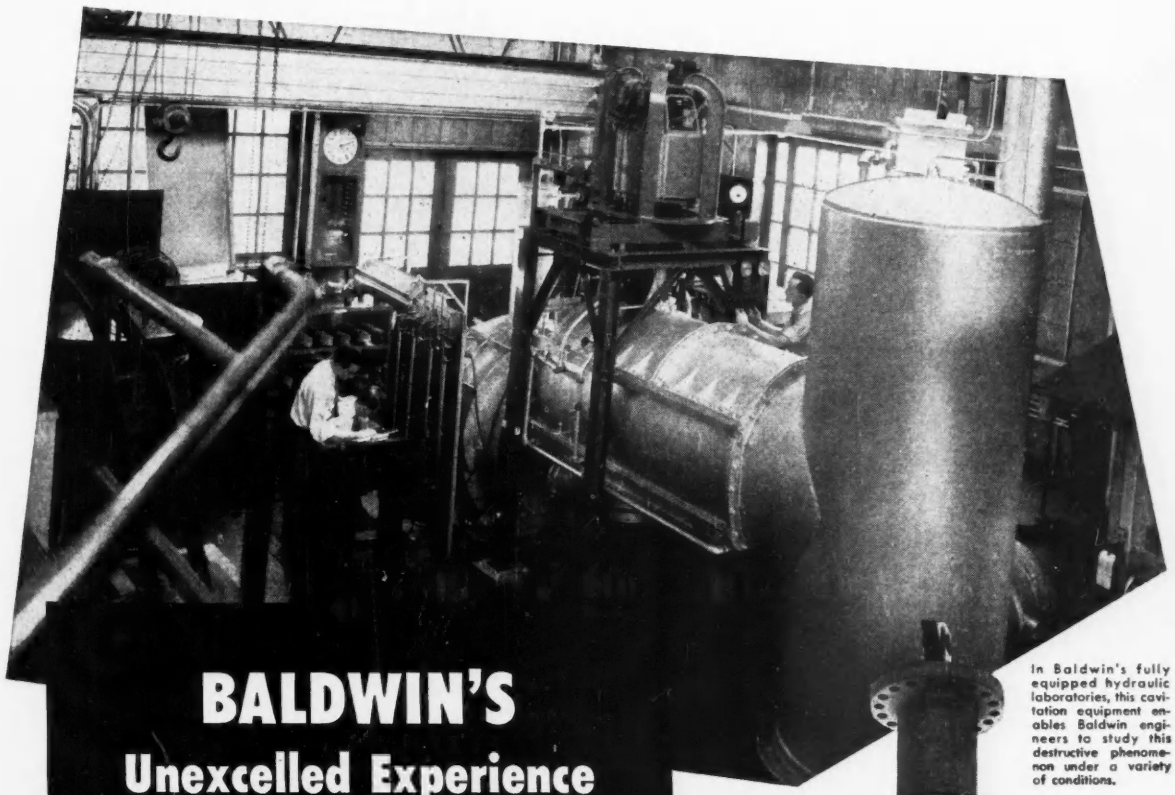

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Intertie Talks

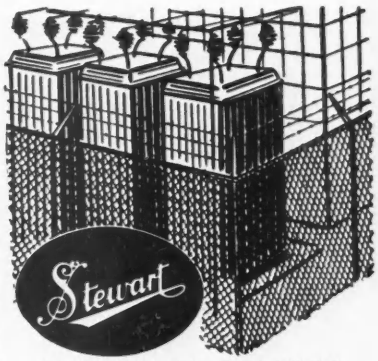
Idaho Power Co and BPA renew discussions on high voltage interconnection

Idaho Power Co and Bonneville Power Administration have renewed discussions directed toward building a high voltage intertie between the Northwest Power Pool's eastern group members and BPA grid in the western group affected by last winter's hydro-shortage. Such a linkup has twice been knocked from BPA budgets by Congress and the federal agency didn't include the proposal in its fiscal 1953-54 plans.

The intertie would be on the Baker-La Grande gap of 43 miles from BPA lines into Pendleton-La Grande, Ore. The Idaho utility has surplus energy in winter months, primarily from steam plants, and in the past winter of Defense Electric Power Administration firm energy curtailment in the western pool the intertie would have allowed BPA to pick up some 75,000 kw. Other increments could have been brought out of Utah. The only existing intertie is a medium capacity line via Montana Power Co through northern Idaho.

Correspondence Continued . . . Talks in this direction were dropped about a year ago, but engineers continued correspondence on technical questions and three weeks ago Idaho's executives asked for a meeting. Preliminary talks have been underway since, according to both Bonneville officials and T. E. Roach, the company's president.

One western group utility executive observed that the chance Idaho may be building hydropower dams in the Snake River's Hells Canyon might have some bearing on renewal of talks. The dams the company has proposed in application to the FPC would provide the Idaho utility with more firm energy capacity than would be necessary for its system. One source estimated Idaho's load growth wouldn't catch up with its potential capacity—if it builds the three Snake river dams —for 15 years. The intertie thus would give Idaho an outlet for its surpluses. For the present, Idaho could take dump power from Bonneville's grid in the summer months and deliver steam-generated energy in storage season months of the western pool operation.



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SEARCHLIGHT SECTION
(Classified Advertising)
H. E. Hilty, Mgr.

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If...

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Be sure to notify us at once, so future copies of ELECTRICAL WORLD will be delivered promptly.

Also make certain you have advised your local Post Master of your new address so other important mail doesn't go astray.

Both the Post Office and we will thank you for your thoughtfulness. Mail the information below to: Subscription Dept., ELECTRICAL WORLD, 330 W. 42nd St., New York 36, N. Y.

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Address .....

City..... Zone.... State.....

Company ..... Title.....

Old

Name .....

Address .....

City..... Zone.... State.....

ELECTRICAL WORLD
330 W. 42nd St.
New York 36, N. Y.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

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AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. E. W.

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ENGINEERS WANTED

Small, rapidly growing privately owned utility has opportunities in distribution and transmission for engineers with and without experience. Have immediate need for engineer to handle all details of 115 kv line and substation design and construction.

NEW MEXICO ELECTRIC SERVICE COMPANY
HOBBS, NEW MEXICO

EARTH AUGER SALESMEN

Demonstrate and sell the well-known PENGO Earth Augers and related products to Utility and Telephone Co.'s, Contractors, State and Federal Govt. Agencies. We furnish Ford Ranch Wagons with sample and demonstrating augers, pay traveling expenses and drawing account against commissions. PENGO Augers are easier to sell than anything we know of. A real good job for real good men. Send full qualifications and snapshot if available, stating whether you have had line construction experience, to Sales Mgr.

PETERSEN ENGINEERING CO. MFRS.
Santa Clara California

NEW CABLE CUTTER

Cuts electric wire, insulated or BX type with ease up to 2½" diam. Unit is portable or can be used in a bench vise. Equipped with powerful worm gear box and wratchet type handle which can be attached to either side. Gear box drives wedge against high carbon blade. Unit is adaptable as a small press. Wht. $12.95 ea. Prepaid.

G. & M. MATERIALS COMPANY
BUY • SELL • TRADE
Merchandise - Machinery - Equipment
12905 Hamilton Av. Detroit 3, Mich.
Phone Townsend 8-6839

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

ADMINISTRATIVE Vice President in 38-45 year age bracket. Qualified to coordinate operating, commercial, and accounting functions and administer company's organization and operations. Operating and/or engineering experience essential. Familiarity wtih rate case preparation and presentation, accounting, san sales promotion desirable. Preferred consideration given to those with multi-utility, combination experience, such as electric-gas, telephone-gas, electric-water, telephone water. Eastern location. Consideration given only to those submitting detailed resumes, including compensation in present employment. Starting salary range (dependent on qualifications)—$13,500-20,000. P-8264, Electrical World.

VICE-PRESIDENT, Operations, in 38-45 year bracket. Qualified to assume full, final responsibility for operations, engineering, and construction. Operating and engineering experience absolute requirement; familiarity with rate analysis, labor negotiations, analysis of manpower requirements desirable. Sufficient experience, knowledge and background to handle all operating and engineering problems of diversified utilities company. Multi-utility experience absolute essential, such as combination electric-gas, telephone-water, etc. Eastern location. Consideration given only to those submitting detailed resumes, including compensation in present employment. Starting salary range (dependent on qualifications)—$12,000-$15,000. P-8265, Electrical World.

INSTRUCTOR, ELECTRICAL Engineering to teach Service courses and Industrial Electronics, beginning September, 1953. Salary and rank open. Apply Electrical Engineering Department, University of North Dakota.

HIGH CALIBER sales-manager with electrical and mechanical background call upon established clientele. Salary guaranty, plus commissions and expense for man with experience, willingness and ability earn attractive income. Headquarters Albuquerque, New Mexico, from 30 to 45, replies confidential. Box 602 Abilene, Texas.

ELECTRICAL PROPERTY Manager in 35-45 year age bracket. Qualified to handle and administer operating commercial and construction activities for 10,000 customer property. Must have actual over-all utility company operating experience; familiarity with public relations, wholesale power sales, work with community organizations and manpower scheduling desirable. Northeastern location. Starting salary range (dependent on qualifications) $6,500-$7,500. P-8161, Electrical World.

POSITIONS WANTED

ELECTRICAL ENGINEER, P.E.—N.Y., 31, 5 years Public Utility and Consulting Engineer, experience with network and transient analyzer studies, relaying, carrier, etc. Desires position with public utility. PW-8175, Electrical World.

EXPERIENCED SWITCHBOARD Operator would like operating job in central or substation. PW-8267, Electrical World.

ENGINEER, EXTENSIVE UTILITY experience with medium-sized electric property in transmission operation, division manager, franchise negotiations, wholesale rate negotiations, rates of earnings, and plant values, and special investigations. Available July 1, 1953. PW-8269, Electrical World.

SELLING OPPORTUNITY WANTED

SALES ENGINEER, Young EE—for home office sales work, with utility meter experience. Large manufacturer located in Pittsburgh area. Some travelling. Salary open. Reply with photograph (optional) and complete resume of education and experience. SA-8332, Electrical World.

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-3984) will be received at Denver, Colorado, until July 16, 1953, for furnishing fourteen (14) 115-kv, 1,200-ampere, 3-pole, manually-gang-operated, outdoor air switches for Oracle Substation, Davis Dam Project, Arizona-Nevada. Delivery is desired within 300 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado.

FRED G. AANDAHL, Assistant Secretary for Water and Power Development Department of the Interior

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-3974) will be received at Denver, Colorado, until July 21, 1953, for furnishing four 115-kv (550-kv BIL), 1,200-ampere, 3,500,000-kva power circuit breakers for Oracle Substation, Davis Dam Project, Arizona-Nevada. Delivery is desired within 360 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado.

FRED G. AANDAHL, Assistant Secretary for Water and Power Development Department of the Interior

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MOTORS—GENERATORS—TRANSFORMERS
New and Guaranteed Rebuilt
1 H.P. to 2500 H.P.
ELECTRIC EQUIPMENT CO.
P. O. BOX 51, ROCHESTER 1, N.Y.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

16-06 33rd ST., NORTH BERGEN, N. J. N.Y.C. Tel. LOngacre 5-3227 N. J. Tel. UNion 7-6300

TRANSFORMERS
1—1500 KVA G.E., 3 Ph., 4150V. 2300V. Pyranol
2— 750 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
2— 750 KVA G.E., 1 Ph., 4600V. 115/230
2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/48V.
3— 333 KVA Whse., 1 Ph., 2400V. 600 V. sec.
3— 300 KVA G.E., 1 Ph., 13200V. 220/440V.
1— 200 KVA G.E., 3 Ph., 2400-220 sec.

SYNCHRONOUS MOTORS
1— 300 H.P., Elec. Mach., 720 RPM. 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM. 220V. 3/60.
2— 150 H.P., Al. Chal. 360 RPM, 440V. 3/60.

MOTOR GENERATOR SETS
1—1000 KW Whse., 600 V. 720 RPM, 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM, 4000 Syn.
1—1000 KW Whse., 275 V. 720 RPM, 4000 Syn.
1— 200 KW Whse., 250V., 900 RPM, 4000V. Syn.
1— 150 KW G.E., 126/250V, 1250 RPM, 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM, 2300V. Syn.

SLIP RING MOTORS
1— 400 H.P., West., CW. 450 RPM, 550V.
1— 250 H.P., West.,CW. 600 RPM, 440V.
1— 200 H.P., West., CW. 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM, 2300V., 3PH, 60 Cy.
1— 100 H.P., G.E., MT 600 RPM, 440V.

Large Stock of A.C. and D.C. Equipment

WANTED

CAPACITORS WANTED

Twelve only, 50,000 volts D.C., .45 microfarads or twenty-four only, 25,000 volts D.C., .85 microfarads. These capacitors are for indoor use. Metal enclosed or porcelain type acceptable. Any capacitors approximating this requirement will be considered. Address all replies giving full details to:

Supreme Power Supplies Limited
Toronto 14, Canada
Attention Purchasing Department

SUBSTATION EQUIPMENT

TRANSFORMERS

Qu.	KVA	MFR.	VOLTAGE
4	2500	Mol.	69000—13800
6	2000	G. E.	66000/114000 Y—2400
4	500	Pitts.	66000/33000—13200/23000 Y
4	500	West.	69000—6900
3	200	Pitts.	66000—2300
4	150	West.	44000/33000—2300/6900
6	100	G. E.	44000—2300
3	75	West.	44000—7200/12470 Y
4	5000	G. E.	40935/70900 Y—14500
3	5000	G. E.	38100/66000—6600
4	500	G. E.	33000—7200/12470 Y
3	400	G. E.	33000—2300/4000
4	333	G. E.	33000—7200/12470 Y
3	250	Mol.	33000—13800/23900 Y
3	200	A. C.	34500—2400/7200/12470 Y
3	100	West.	33000—240/480 NEW
3	75	Wag.	33000—7200/12470 Y
6	2125	G. E.	26400/13200—2300
4	1500	A. C.	25400/44000 Y—6900/13800
4	450	A. C.	25410/44000—13280/23000
6	100	G. E.	22000—7200/12470 Y
3	50	G. E.	22000—2300
1	5000	Pitts.	13200—4600, 3 ph.
1	600	Stand.	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	250	West.	13800—480/240
3	200	G. E.	13800—2300
3	250	Pitts.	7200—220/440
3	100	G. E.	7200—240/480
3	75	G. E.	7200—240/480
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
4	150	G. E.	4800/2400—240/120
2	100	G. E.	4800/2400—480/240
3	333	G. E.	2400/4160 Y—240/480
3	400	G. E.	2400/4160 Y—480
3	250	G. E.	2300/4000 Y—115/230
2	250	West.	2300—460/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G. E.	2300—575, 3 ph.
6	50	West.	2400—114/228 DRY TYPE

INDUCT. REGULATORS—OUTDOOR

1—140 KVA G. E. 200 A. 4000 V. 3 ph.
4—60 KVA West. 240/500 A. 2400 V. 1 ph.
3—48 KVA West. 200 A. 2400 V. 1 ph.
8—36 KVA West. 150/300 A. 2400 V. 1 ph.
2—36 KVA G. E. 75/150 A. 4800 V. 1 ph.

CIRCUIT BREAKERS

2—400 A. 37 KV G. E. FHKO-136-350 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
4—600 A. 15 KV G. E. FHKO-139-750 MVA

BREW, WOLTMAN & CO., INC.
52 Church St., New York 7, New York

TRANSFORMERS

FOR SALE

6—1000 KVA Mol. 11500—2400/4160Y
3— 500 KVA G-E 22000—2300/4000Y
3— 333 KVA W-H 6600—2300
5— 333 KVA Mol 7200/12470Y—2400/4160Y
3— 200 KVA G-E 22000—2300
3— 150 KVA G-E 44000—600/2400
3— 150 KVA G-E 19050/33000Y—2540/4000Y
2— 150 KVA G-E 6900—230/460
3— 100 KVA G-E 33000—6900/11950Y
3— 100 KVA G-E 13200—2300
3— 50 KVA A-Ch 33000—6900/11950Y
3— 50 KVA A-Ch 33000—2400/4160Y
3— 50 KVA A-Ch 13200—2300/4600

Many other items in stock.

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
CINCINNATI 27, OHIO

40 Years Dependable Service

TURBO GENERATOR
Available Immediately
7500 KW G.E. Co.
180 P.S.I.—525°F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
GOOD CONDITION
Union Electric Co. of Missouri
315 N. 12th Blvd. St. Louis 1, Mo.

LARGE QUANTITIES OF NEW AND USED MACHINERY AND EQUIPMENT

Diesel Engines — Diesel Generators — Turbo-Generators
AC motors from 5 HP to 6000 HP — DC motors from 5 HP to 1500 HP
AC and DC Generators up to 4600 KW

Boilers — Turbines — Gear Reducers — Motor Starters
Condensers — Air ejectors — Coolers — Heat Exchangers
Pumps — Compressors — Blowers — Vacuum Pumps
Steel Tanks — Switchboards — Transformers — Gasoline Engines
Axial Flow Fans — Exhaust Fans — Diesel Engine Parts
Machine Tools — Hicycle Tools — Forging Hammers
Welding Machines — Welding Rods — Pile Driving Hammers
Wire Rope and Cable — Towing Hawser — Crushers
Centrifugal Casting Machines — Oxygen Producing Plant
Blasting and Communication Wire — Concrete Brickmaking Machines
Searchlights — 1000 Watt Electric Light Bulbs — Winches
LST Equipment — Laundry Equipment — Furnaces

EQUIPMENT FOR: Contracting—Mining Ship and Metal Working and hundreds of other items too numerous to list.

ASK FOR OUR NEW CATALOGUE JUST PUBLISHED.

HUGO NEU CORPORATION
31 Nassau Street—New York, N. Y. Telephone—Rector 2-1334

EASTERN SCRAP & SALVAGE CORPORATION
65 Muirheid Avenue—Trenton 7, N. J.
Telephone 5-6349

FROM AVAILABLE STOCK

TURBO GENERATORS IN STOCK

Q.	KW	Make	Resc.
1—	1000	G.E.	Non-Cond—190 lbs-2400-3-60
1—	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1—	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1—	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter
1—	400	Westgh.	Non-Cond—125/150 lbs., 5/10 lbs. B.P., 240/480-3-60
1—	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B.P., 480-3-60

FREQUENCY CHANGERS

Qu	Kva	Make	Cycles	Voltages
1—	12500	Whse.	25/60	13200 x 13200
1—	3750	G.E.	25/60	4150/2400 x 2400/4150
1—	3125	G.E.	25/60	4150/2400 x 2400/4150
2—	2500	G.E.	25/62½	2300 x 4160
1	1250	G.E.	25/58.3	4400 x 2300
1	625	A.C.	25/60	11000 x 2300

MOTOR GENERATOR SETS
3 ph, 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
1—	2000	G.E.	514	600	6600/13200
2—	2000	G.E.	500	666 25 cy.	11000
1—	1500	G.W.	514	115	4000/13800
1—	1500	G.E.	720	600	13200
1—	1500	G.E.	360	275	2200/4400
3—	1500	G.E.	514	250	6600/13200
1—	1500	G.E.	600	600	2300/4150
1—	1000	G.E.	900	260	4100/6900
2—	1000	Whse.	900	600	2300/4150
1—	750	Whse.	900	275	2300/4150
1—	500	Whse.	900	250	6609/13200
1—	500	Whse.	1200	125/250	2300
1—	500	Whse.	900	250	440
1—	500	G.E.	720	125	2300
1—	400	G.E.	720	250	440/2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
1—5000	Whse.	OISC	3	33000x26400/13200
1—2500	Whse.	OISC	3	26400/13200 x 480
3—1250	G.E.	HVDDJ		6600x550
1—1150	A.C.	OISC		3200x480/2400
3—1000	G.E.	HVDDJ	1	2200/480

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OFFICE & SHOP
51 Howell St. Jersey City 6, N. J.

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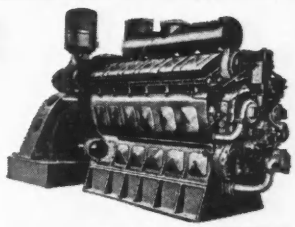
• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS



A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1980	Nordberg	TS-217	2800	225	320	Enterprise	DSG-6	560	450
1500	Fairbanks Morse	33E16	2000	300	300	General Motors	8-268A	450	1200
1136	Fairbanks Morse	38D	1600	720	250	Fairbanks Morse	37-E	375	360
1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	350	900
750	General Motors	12-567	1080	720	150	Worthington	CC-4	225	450
500	Baldwin	VO-8	750	514	150	Buckeye	80	240	600
500	General Motors	8-278A	750	720	100	Worthington	BB-5	150	600
500	General Motors	8-567	720	720	100	General Motors	3-268A	150	1200
400	Ingersoll-Rand	S-8	600	720	60	General Motors	6-71	90	1200
350	Baldwin	VO-6	510	450	30	Internat'l Harvester	UD-14	45	1200

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

How much STRENGTH should a bus conductor have?

Indoors or outdoors you want bus conductors that have maximum structural strength. Chase square copper tube bus conductors have relatively large cross-sectional areas, permitting longer spans between supports.

The high mechanical strength of Chase buses is also important in withstanding the powerful forces caused by heavy short circuit currents.

For ventilated square copper tube bus conductor as well as round tube and flat rectangular bus, insist on Chase.

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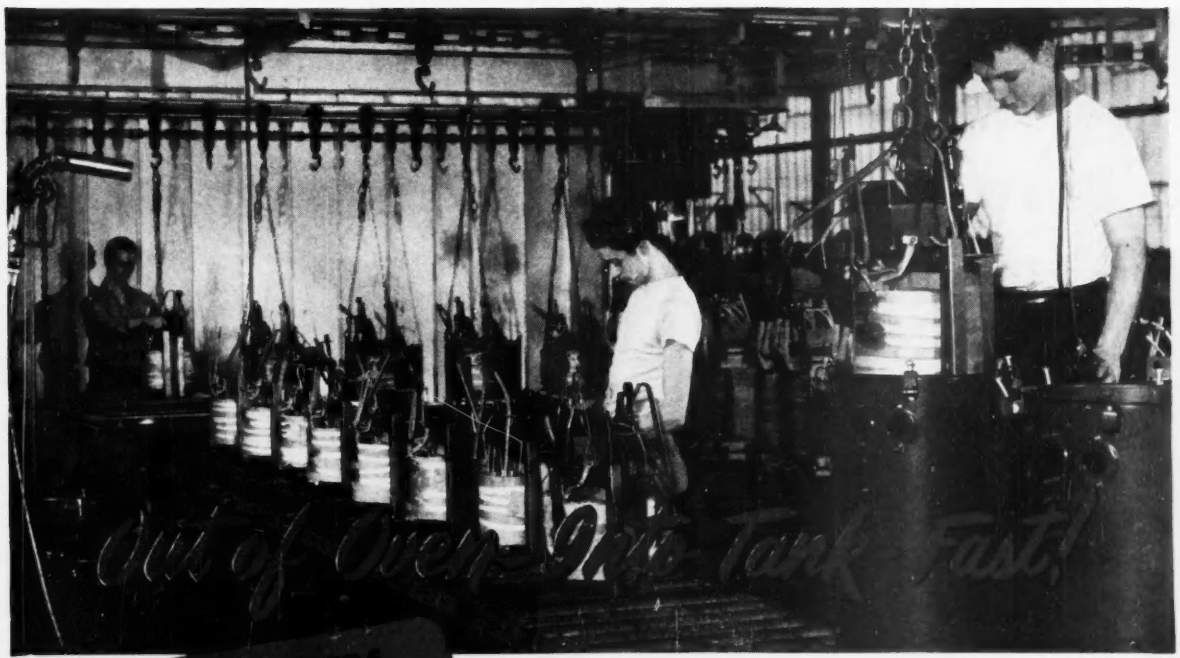
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston	Newark	Rochester †	(† sales
Cincinnati	Indianapolis	New Orleans	St. Louis	office only)

How Moisture is Kept Out of Transformer Coils



Fast sequence from drying oven into tank is one reason why you get consistently excellent insulation quality in Allis-Chalmers distribution transformers.

Here's How It's Done

Core and coil assemblies move continuously through the tunnel-type electrically heated oven partly shown in the background above. Then . . . immediately after the drying cycle is complete . . . they are immersed in dry oil in their own tanks. This prevents any absorption of moisture that might have occurred if the cooling had been done in air. Then a vacuum drawn on the transformer removes any air entrapped in the oil.

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As a final step, production line impulse testing is used to assure uniform high insulation strength.

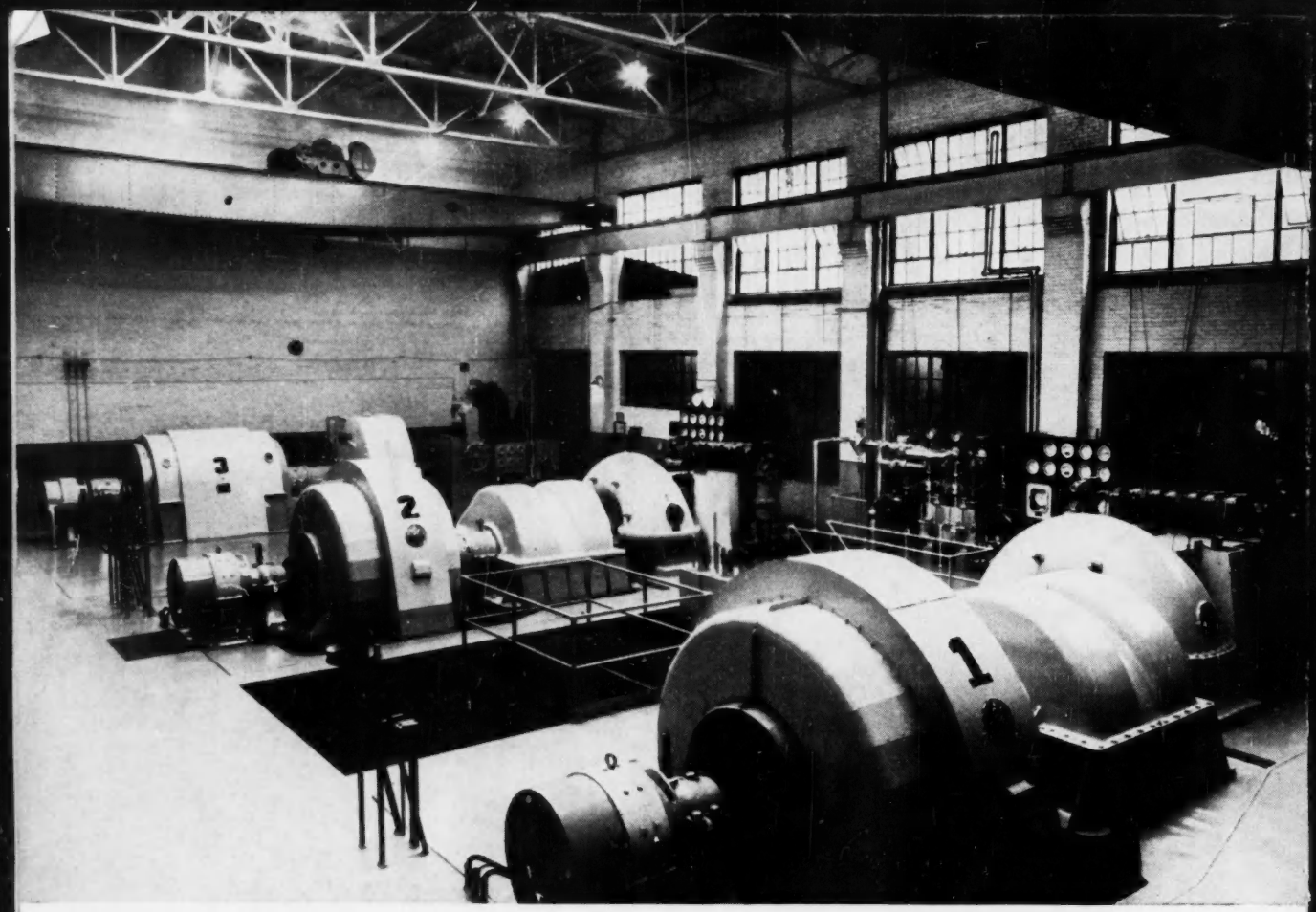
Get All Benefits

Careful attention to manufacturing detail is only one of the many reasons why you benefit when Allis-Chalmers distribution transformers are on your system. For complete information, call your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wis.

A-3977

ALLIS-CHALMERS

A-C ALLIS-CHALMERS



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NONPAREIL
TRADE MARK
Turbine Oil

• Turbine oil changed every three years, oil systems cleaned every year, filters cleaned every four months . . . that was the oil system maintenance routine in the power plant of a mid-west paper mill before the switch was made to NONPAREIL Turbine Oil.

Recommended by a Standard Oil lubrication specialist, NONPAREIL has been used for 17 years in the plant's two 4,000-KW units and for 12 years in its 5,000-KW unit. The original fills of oil have never been removed from the turbines. Neutralization numbers have remained below 0.09 mg. KOH/gm. The oil systems have never needed cleaning.

While the lubricant and maintenance savings already realized by this power plant are impressive, they are just a beginning. Trouble-free lubrication and consequent savings are *assured for the life of these turbines.* This is based on the written guarantee, given with each fill of NONPAREIL, that this unique lubricant will last as long as the turbine, and that its neutralization number will stay below 0.15 mg. KOH/gm.

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STANDARD OIL COMPANY
(Indiana)

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STANDARD